

**FINAL
ENVIRONMENTAL ASSESSMENT
FOR THE
IMPLEMENTATION OF THE
INTEGRATED NATURAL RESOURCES
MANAGEMENT PLAN
FOR
REDSTONE ARSENAL, ALABAMA**



***U.S. ARMY GARRISON, REDSTONE
REDSTONE ARSENAL, ALABAMA***

OCTOBER 2002

**FINDING OF NO SIGNIFICANT IMPACT (FNSI)
FOR THE ENVIRONMENTAL ASSESSMENT FOR THE
IMPLEMENTATION OF THE
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
FOR REDSTONE ARSENAL, ALABAMA**

BACKGROUND: Redstone Arsenal is located in Madison County, Alabama, southwest of and adjacent to the City of Huntsville. Prior to acquisition by the Army, the land comprising the current Redstone Arsenal was used for producing cotton, corn, hay, small grain crops, and livestock. The original land was purchased in 1941 and 1942 from 320 landowners as part of the Siebert Arsenal Project. Under this project, the Huntsville Arsenal and Redstone Arsenal were constructed to manufacture chemical munitions. In 1949, the two Arsenals were joined to create the contemporary Redstone Arsenal, with an approximate 32,000 combined acres. Over the ensuing years, the Arsenal's acreage has fluctuated. The Arsenal currently has a total area of 37,910 acres (including special-use permit land) and is approximately six miles wide and ten miles long.

DESCRIPTION OF THE PROPOSED ACTION: The U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, proposes to manage Installation natural resources under a five year (Fiscal Years 2002-2007) Integrated Natural Resources Management Plan (INRMP). Implementation of this INRMP would conserve and protect natural resources, build upon established relationships with federal, state and local agencies, and support the military mission. The INRMP would provide an inventory of natural resources and outline procedures for managing soil, timber, grasslands, and water resources for the benefit of resident fish and wildlife resources on the Arsenal. The INRMP would also facilitate compliance with environmental laws, regulations, and policies, including Army Regulation (AR) 210-10, *Procedures for Maintaining Continuity of Essential Facilities, Engineering Functions at Army Installations*; AR 200-3, *Natural Resources Land, Forest, and Wildlife Management*; Technical Manual (TM) 5-630, *Natural Resources Land Management*; TM 5-631, *Natural Resources Forestry Management*; TM 5-632, *Military Entomology Operations Handbook*; Public Law (PL) 99-561; Department of Defense (DoD) Directive 4700.4, *Natural Resource Management Program*; and DoD Directive 4715.3, *Environmental Conservation Program*. It would also integrate natural resources management into other Installation plans, including the master plan, the cultural resources management plan, and military training plans and schedules.

ALTERNATIVES CONSIDERED: The only other alternative considered, in addition to the Preferred Alternative (Proposed Action), was the No Action alternative. Under this alternative, the Army would not implement the INRMP but would manage the natural resources of the Arsenal with basic ecosystem management. Although this approach focuses on ecosystem management and includes multiple-use practices, it lacks

a fully integrated approach, making it inconsistent with the integrated management approach set forth in the requirements of the Sikes Act Improvement Act (SAIA).

The Preferred Alternative emphasizes a comprehensive and integrated approach to natural resources management. It utilizes information from the various baseline studies and surveys that Redstone Arsenal has completed in support of ecosystem management practices. The INRMP presents program-wide vision and mission statements, and establishes specific management goals and objectives for each resource area. Elements of multiple-use practices are retained and additional considerations are included.

ENVIRONMENTAL EFFECTS: Eleven broad environmental components were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the significance of potential impacts. The environmental components considered are air quality, biological resources, cultural resources, hazardous materials and waste, health and safety, infrastructure and transportation, land use, noise, geology and soils, socioeconomics, and water resources. Cumulative impacts of the Proposed Action to these environmental components were also analyzed.

Neither the No Action Alternative nor the Preferred Alternative would have significant impacts on air quality, hazardous materials and waste and noise. Both alternatives would have beneficial effects on the remaining resource categories.

CONCLUSION: The Directorate of Environment and Safety has prepared an environmental assessment that addresses the Proposed Action and evaluates the environmental impacts of the Proposed Action based on the conclusion of the Environmental Assessment of the INRMP for Redstone Arsenal, October 28, 2002. We conclude that there are no significant environmental impacts associated with this action that would require the preparation of an Environmental Impact Statement.

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION AND MISSILE COMMAND
REDSTONE ARSENAL, ALABAMA

FINDING OF NO SIGNIFICANT IMPACT
FOR THE ENVIRONMENTAL ASSESSMENT OF THE
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
FOR REDSTONE ARSENAL

PREPARED OCTOBER 28, 2002

PROPONENT OF THE ACTION:

REVIEWED BY:

Date _____
DANIEL J. DUNN
Chief, Natural Resources Division
Directorate of Environment and Safety

Date _____
DANIEL J. DUNN
Chief, Natural Resources Division
Directorate of Environment and Safety

PREPARED BY:

REVIEWED BY:

Date _____
DAVID NIXON
Wildlife Biologist
Directorate of Environment and Safety

Date _____
CAROLENE WU
NEPA Coordinator
Directorate of Environment and Safety

REVIEWED BY:

FINAL APPROVAL BY:

Date _____
AMY S. MEREDITH
Attorney Advisor

Date _____
ROBERT J. DEVLIN
Colonel, OD
Garrison Commander

APPROVED BY:

Date _____
TERRY W. HAZLE
Director
Directorate of Environment and Safety

EXECUTIVE SUMMARY

INTRODUCTION

Redstone Arsenal is located in Madison County, Alabama, southwest of and adjacent to the City of Huntsville. Prior to acquisition by the Army, the land comprising the current Redstone Arsenal was used for producing cotton, corn, hay, small grain crops, and livestock. The original land was purchased in 1941 and 1942 from 320 landowners as part of the Siebert Arsenal Project. Under this project, the Huntsville Arsenal and Redstone Arsenal were constructed to manufacture chemical munitions. In 1949, the two Arsenals were joined to create the contemporary Redstone Arsenal, with an approximate 32,000 combined acres. Over the ensuing years, the Arsenal's acreage has fluctuated. Redstone Arsenal currently has a total area of 37,910 acres (including special-use permit land) and is approximately six miles wide and ten miles long.

The purpose of this Environmental Assessment (EA) is to address the impacts to the environment from the different natural resources management alternatives proposed in the recently updated Integrated Natural Resources Management Plan (INRMP, 2002) for Redstone Arsenal. Effective management of natural resources will allow RSA to continue to meet military mission requirements, while protecting and enhancing the natural environment. To accomplish this goal, the U.S. Army Aviation and Missile Command (AMCOM), through coordination with the U.S. Fish and Wildlife Service, proposes to implement the 2002 INRMP.

DESCRIPTION OF THE PROJECT

The Proposed Action is to implement the recently updated INRMP (May 2002) in a timely, and effective manner. The INRMP will guide natural resources management on the Arsenal from 2002 through 2007. Implementing the INRMP would conserve and protect natural resources, build upon established relationships with federal, state and local agencies, and support the military mission at RSA. The INRMP would provide an inventory of natural resources and outline procedures for managing soil, timber, fish and wildlife, and grassland for the benefit of resident fish and wildlife resources on the Arsenal. The INRMP would also facilitate compliance with environmental laws, regulations, and policies, including the Army Regulation (AR) 210-10, *Procedures for Maintaining Continuity of Essential Facilities, Engineering Functions at Army Installations*; AR 200-3, *Natural Resources Land, Forest, and Wildlife Management*; Technical Manual (TM) 5-630, *Natural Resources Land Management*; TM 5-631, *Natural Resources Forestry Management*; TM 5-632, *Military Entomology Operations Handbook*; Public Law (PL) 99-561, *SAIA*; Department of Defense (DoD) Directive 4700.4, *Natural Resource Management Program*; and DoD Directive 4715.3, *Environmental Conservation Program*.

By definition, the INRMP for RSA would integrate all plans and programs related to natural resources management. The INRMP would incorporate principles of ecosystem management and would contain sufficient information for resource managers to make informed decisions and enhance the practice of adaptive management.

The 2002 INRMP consists of four sections. Section I contains a general description of the plan, and Section II contains information pertaining to Installation land management and grounds maintenance. Section III discusses forest management, while Section IV discusses fish and wildlife management. There are 26 appendices associated with the INRMP.

ALTERNATIVES CONSIDERED

Two alternatives were considered in this EA: The Preferred Alternative, an integrated ecosystem management approach under the 2002 INRMP, and the No Action Alternative, a basic ecosystem management approach. The Preferred Alternative emphasizes a comprehensive and integrated approach to natural resources management. It utilizes information from the various baseline studies and surveys that RSA has completed in support of ecosystem management practices. The INRMP presents program-wide vision and mission statements, and establishes specific management goals and objectives for each resource area. Elements of multiple-use practices are retained, and additional considerations are included.

Under the No Action Alternative, the Army would not implement the 2002 INRMP and would continue the current management program. Although this approach focuses on ecosystem management and includes multiple-use practices, it lacks a fully integrated implementation approach through an INRMP, making it inconsistent with the requirements of the SAIA.

METHODOLOGY

The purpose of this EA is to analyze the potential environmental consequences of the Proposed Action in compliance with the National Environmental Policy Act (NEPA); DoD Directive 6050.1, *Environmental Effects in the United States of Department of Defense Actions*; and 32 Code of Federal Regulations (CFR) Part 651, *Environmental Analysis of Army Actions*.

Eleven environmental components were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the significance of potential impacts. These environmental component areas are air quality, biological resources, cultural resources, hazardous materials and waste, health and safety, infrastructure and transportation, land use, noise, geology and soils, socioeconomics, and water resources.

To assess the significance of environmental impacts, a list of activities necessary to accomplish the Proposed Action was developed and the environmental setting was described. Next, those activities with the potential for significant environmental consequences were identified. The significance criteria used to evaluate the environmental effects of program activities include three levels of impacts: no impact, no significant impact, and significant impact.

RESULTS

This section summarizes the conclusions of the analyses made for each of the areas of environmental consideration based on the application of the described methodology.

AIR QUALITY - There would be no significant impacts to air quality from implementing the INRMP. Federal and state ambient air quality standards concentrations would not be exceeded due to INRMP activities. While the periodic prescribed burning on the Arsenal would emit smoke during the actual burning event, the small amount of acreage burned at any one time and the varied schedule for burning would not be anticipated to create significant impacts to air quality if RSA's prescribed burning procedures are followed. These procedures are designed to ensure compliance with federal, state, and local requirements.

BIOLOGICAL RESOURCES - While there would be no significant impacts to biological resources from implementing the INRMP, existing biological resources would be positively impacted and protected from encroachment by Installation activities.

Vegetative Communities

Implementing the Forest Management Plan of the INRMP would improve sustainability of healthy, diverse, and productive forest resources on the Installation. Additionally, visual resources would benefit from the structured replanting of harvested areas and the continued improvement of timber stands. Forested lands on the Arsenal would continue to be properly maintained and logging operations would continue. Varied forest compartments are slated for timber harvesting each year from 2002 through 2007. Harvests are aimed toward reducing overstocked timber stands in order to increase the rate of growth and simultaneously decrease the rate of tree mortality. Ecotones would be maintained which would help to increase habitat diversity, establish vegetative corridors for animal movement, and maintain control along fence lines and field edges.

Fish and Wildlife Communities

Implementing the Fish and Wildlife Management Plan of the INRMP would improve the sustainability of healthy, diverse, and productive plant and animal communities reflective of a naturally balanced ecosystem. Harvestable populations of deer, turkey, fish, and gamebirds would be maintained. Native plant communities as well as nongame species would also be encouraged.

Wetlands

Implementing the INRMP would improve the sustainability of plant and animal species diversity and numbers on the Arsenal's 9,873 acres of wetlands. Since wetlands are one of the most biologically productive natural ecosystems in the world, managing RSA's wetland resources is critical to sustaining biodiversity in the defined region of influence and beyond.

Aquatic Resources

Aquatic habitats and the broad range of species found in the 10,000 acres of the Arsenal affected by the Tennessee River and other tributary systems would be managed and improved to further support biodiversity in the region of influence and beyond.

Threatened and Endangered Species

Implementing the Endangered Species Management Plan of the INRMP would ensure that the threatened and endangered flora and fauna indigenous to RSA are afforded the special protection provided under the Endangered Species Act.

Unique Habitats

The numerous unique habitats located throughout Redstone Arsenal would be afforded special protection by implementing the INRMP. Unique habitats found on RSA include aquatic cave communities, terrestrial cave communities, and springs.

Implementing the INRMP would ensure that the application of herbicides on or near aquatic resources receives close review to avoid potential effects on both non-target plants and animals that depend on these resources.

CULTURAL RESOURCES - There would be no significant impacts to cultural resources from implementing the INRMP. Using a coherent management system, existing cultural resources would be protected from encroachment by Installation activities. No timber harvesting, site preparation, plowing, disking, or other type of excavation would be performed without prior written approval of the staff archeologist.

Proposed INRMP work activities that involve the movement or disturbance of earth, alterations to buildings or structures that might be eligible for the National Register of Historic Places, impact to potential archeological sites, or other environmental impacts are examined by the Project Review Committee, which includes the Arsenal's NEPA Coordinator and a Master Planning Division representative. The staff archeologist conducts a reconnaissance survey to determine if any cultural resources will be impacted by the proposed work and recommends modifications or initiation of action such as a Phase II Archeological Survey, if necessary. All Phase II Archeological Surveys are coordinated with the State Historic Preservation Office for concurrence prior to beginning the survey and prior to any earthwork or building alterations.

During INRMP activities any items observed that might have historical or archaeological value will be reported immediately so that the Cultural Resource Manager may determine their significance and any special disposition of the finds. Activities in the area of the discovery that may result in the destruction of these resources would cease and personnel would be prevented from trespassing on, removing, or damaging such resources.

HAZARDOUS MATERIALS AND WASTE - No significant impacts would result from hazardous materials and waste, since fertilizers and pesticides would be used and disposed of properly.

HEALTH AND SAFETY - There would be no significant impacts to health and safety from implementing the INRMP. However, by using a coherent management system, existing health and safety conditions would be enhanced.

There would be beneficial impacts to fire safety on Redstone Arsenal by using prescribed burning, firebreaks and grazing lands to reduce fire danger. Prescribed burning procedures at RSA are designed to ensure compliance with federal, state, and local requirements. Firebreaks and utility rights-of-way (which serve as firebreaks, in addition to their primary purpose) will be maintained under the INRMP to impede fire progress and serve as trails to transport fire-fighting equipment to otherwise inaccessible areas, should fires occur.

INFRASTRUCTURE AND TRANSPORTATION - There would be no significant impacts to infrastructure and transportation from implementing the INRMP. By establishing a coherent management system to prevent the overgrowth of vegetation along utility rights-of-way on the Arsenal, potential negative impacts to the infrastructure would be avoided. By controlling vegetation growth, utility access (e.g., power lines, natural gas lines) would be maintained. Utility outages caused by restrictive overgrowth interfering with infrastructure such as utility lines, utility substations, water treatment plants, wells, and wastewater pumping stations would be minimized. Proper maintenance of utility rights-of-way and fire breaks are mutually supportive, in that both protect infrastructure and minimize infrastructure loss and service disruptions whenever natural disasters or other incidents occur.

LAND USE - While there would be no significant impacts to land use from the implementing the INRMP, there are several beneficial impacts described below.

By using a coherent management plan on the Arsenal, the fourteen major land use areas (administration, airfield, community facilities, family housing, industrial, maintenance, medical, the National Aeronautics Space Administration (NASA), open space, outdoor recreation, range/test areas, supply/storage, training facilities, and unaccompanied personnel housing) would be maintained. The three land uses on the Arsenal (classified as improved, semi-improved, and unimproved grounds) would continue in a planned manner.

The current use of available agricultural land for grazing and hay production would continue. The estimated grazing activity from 2002 through 2007 is 1,885 head of cattle

per year. The total value of services received by the Government is estimated at \$244,985 per annum on 3,769 acres of agricultural leased land. Idle lands would be kept to a minimum.

NOISE - There would be no significant impacts to noise from implementing the INRMP. Normal noise producing activities on the Arsenal would continue, and the INRMP would not cause any excessive noise during its implementation.

GEOLOGY AND SOILS - There would be no significant impacts to geology and soils from implementing the INRMP. By establishing a coherent management system to prevent the devegetation and deforestation of RSA, positive impacts to soils would be expected and potential negative impacts (e.g., sheet flow and gully erosion) would be avoided. By controlling these erosion factors, siltation and turbidity of the streams and creeks would also be minimized.

Positive impacts (e.g., minimal soil erosion and siltation of waterways) would be expected by following the lands maintenance and soil erosion control measures and guidelines found in the Land Management and Grounds Maintenance Plan and the Erosion Control Plan. Having an approved procedure in place prior to awarding contracts involving land disturbances would allow contractors to include erosion control costs in the project budget.

SOCIOECONOMICS - There would be no significant impacts to socioeconomics from implementing the INRMP. There would be no impacts to population or employment in the region. There are positive impacts to Installation recreation facilities and to the economics at RSA from grazing, timber cutting, and associated agricultural lease activities.

Impacts to outdoor recreation facilities on the Arsenal would be positive. The golf course, playing fields, picnic areas, campgrounds, boat ramps, fishing piers, and swimming facilities would be maintained with vegetation pruned and facilities kept in good repair.

By establishing a coherent management plan on RSA, grazing activities, logging operations, and agricultural lease arrangements would continue as a source of revenue for the U. S Army. These activities provide revenue to the Army from direct cash leases as well as an increase in additional services that provide indirect value to the government (e.g., mowing, seeding, fertilization, fence repair by the lessee). This revenue is estimated to be \$244,985 per annum. Revenue from timber sales would total approximately \$127,700 per year from FY 2002 through FY 2007. Money derived from the sale of hunting and fishing permits would continue to be used exclusively for the management of fish and wildlife resources on the Arsenal.

WATER RESOURCES - There would be no significant impacts to water resources from implementing the INRMP. With a coherent management system to prevent the siltation and erosion of stream banks, positive impacts to water resources would result. By controlling these factors, streams that cross the Arsenal would continue to be

classified as fish and wildlife areas, and groundwater would continue to be a usable resource.

Providing guidelines to RSA personnel and contractors prior to the commencement of activities that could potentially impact water resources would save money and increase efficiency. Prior planning would also allow contracts to include measures to avoid impacting water resources.

Providing water supplies for cattle, other than streams, would avoid cattle from eroding stream banks and further polluting streams with excretions. This practice would protect the surface and ground water resources of the Arsenal.

MITIGATION

Mitigation involves avoiding impacts, minimizing impacts, and taking actions to compensate for unavoidable impacts. Impact avoidance and impact minimization have already been considered in the planning process, and have been included in the management initiatives of the alternatives. No required mitigation for significant impacts has been identified for the alternatives as presented.

The following general actions are provided to support implementation of any of the alternatives and may be used at the implementation stage of specific natural resources management actions:

- Implement practices of conservation landscaping and low-impact development to avoid and minimize any adverse impacts to water resources.
- Assess land-disturbing activities to determine alternatives with less adverse impact, work to control erosion, and enforce land-use restrictions that help avoid and minimize adverse impacts to soil resources and shoreline areas.
- Examine project siting to avoid or minimize adverse impacts to forest resources. Projects will be planned to avoid conservation areas and native tree species that add value to wildlife habitat, including wetland and riparian areas.
- Avoid or minimize adverse impacts to wildlife resources by assessing the need, location, and timing of projects that may affect habitat areas.
- Coordinate with the Cultural Resources Manager within the Directorate of Environmental Management to avoid or minimize any adverse cultural resources effects resulting from land-disturbing projects. Where avoidance is impractical, appropriate mitigation measures for the loss of National Register-eligible properties will be determined through the National Historic Preservation Act, Section 106 consultations between representatives of AMCOM, the Alabama State Historic Preservation Officer, and the Advisory Council on Historic Preservation.

As necessary, subsequent environmental analysis and NEPA documentation will be conducted for specific management actions prior to their implementation. In addition, project-specific NEPA documentation may need to be developed for those actions that have the potential for environmental impacts.

CONCLUSION

The Preferred Alternative to implement the INRMP would most effectively manage and preserve the natural resources found on RSA as required by federal regulations and Army policies. If the Preferred Alternative were selected, RSA would implement the INRMP in a timely and effective manner. Under this integrated ecosystem management approach, many of the initiatives discussed under the basic ecosystem management alternative (No Action) are continued or implemented. However, objectives that concentrate on ecosystem integrity and biodiversity are emphasized. In addition, implementation of this alternative complies with applicable federal, state, and local laws, and pertinent Army regulations and guidance documents. Beneficial impacts to biological resources, cultural resources, health and safety, infrastructure and transportation, land use, geology and soils, socioeconomics, and water resources are anticipated. Under the INRMP resource management activities would be consolidated under one plan and be carried out more efficiently and effectively, resulting in cost savings and beneficial impacts to all resource areas.

The No Action Alternative (Basic Ecosystem Management) follows an ecosystem approach, and also complies with applicable federal and state laws. However, it does not fully comply with DoD and Army regulations derived from the SAIA amendments that mandate the preparation and implementation of INRMPs. Under this alternative, there would be no anticipated impacts to air quality. Beneficial impacts would be anticipated to the other resource areas. These beneficial impacts would result from the continuation of management actions, including enhancing native habitat conditions, managing invasive or exotic species, correcting and preventing stormwater problems, monitoring and protecting wetlands, protecting resource protection areas, practicing integrated pest management, implementing and enforcing water resources protection regulations, and managing wildlife populations. Beneficial cultural resources impacts would also occur under this alternative from the continued protection of known sites. Socioeconomics would benefit from the direct and indirect revenues generated from continued hunting, fishing, and passive recreational opportunities.

LIST OF ACRONYMS AND ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
ALNHP	Alabama Natural Heritage Program
AMCOM	U.S. Army Aviation and Missile Command
AR	Army Regulation
CAA	Clean Air Act
CD	Cords
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
dB	Decibels
dBA	A-weighted Decibels
DDT	Dichlorodiphenyltrichloroethane
DoD	Department of Defense
DOT	Department of Transportation
DPW	Department of Public Works
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FY	Fiscal Year
INRMP	Integrated Natural Resources Management Plan
MBF	Thousand Board Feet
MSL	Mean Sea Level
MVA	Megavolts Absolute
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO ₂	Nitrogen Dioxide

NRHP	National Register of Historic Places
NRMP	Natural Resources Management Plan
NWI	National Wetlands Inventory
O ₃	Ozone
OSHA	Occupational Safety and Health Administration
PAB	Palustrine Aquatic Beds
Pb	Lead
PCB	Polychlorinated Biphenyls
PEM	Palustrine Emergent
PFO	Palustrine Forested
PL	Public Law
PM-10	Particulate matter with an aerodynamic diameter less than or equal to 10 microns
Pmulti	Palustrine Overlapping Types
PSS	Palustrine Scrub-Shrub
PUB	Palustrine Unconsolidated Bottoms
PUS	Palustrine Unconsolidated Shoreline
RCRA	Resource Conservation and Recovery Act
SAIA	Sikes Act Improvement Act
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SHPO	State Historic Preservation Office
SO ₂	Sulfur Dioxide
SWDF	Solid Waste Disposal Facility
TCE	Trichloroethylene
TM	Technical Manual
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WNWR	Wheeler National Wildlife Refuge

TABLE OF CONTENTS

EXECUTIVE SUMMARY	ES-1
LIST OF ACRONYMS AND ABBREVIATIONS	i
TABLE OF CONTENTS	iii
 CHAPTER 1.0 INTRODUCTION	 1-1
1.1 Background.....	1-1
1.1.1 Description of the Proposed Action.....	1-1
1.1.2 Purpose and Need for the Action	1-3
1.1.3 Location	1-4
1.2 Related Environmental Documentation.....	1-6
1.3 Agencies Involved in Environmental Analysis	1-6
1.4 Public Involvement	1-6
 CHAPTER 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION	 2-1
2.1 Summary of Alternatives	2-1
2.2 Description of Alternatives.....	2-2
2.2.1 Preferred Alternative -- Integrated Ecosystem Management	2-2
2.2.2 No-Action Alternative -- Basic Ecosystem Management	2-3
2.3 Comparison of Environmental Consequences	2-3
 CHAPTER 3.0 AFFECTED ENVIRONMENT.....	 3-1
3.1 AIR QUALITY	3-1
3.2 BIOLOGICAL RESOURCES	3-3
3.3 CULTURAL RESOURCES	3-14
3.4 HAZARDOUS MATERIALS AND WASTE.....	3-15
3.5 HEALTH AND SAFETY	3-16
3.6 INFRASTRUCTURE AND TRANSPORTATION	3-17
3.7 LAND USE.....	3-19
3.8 NOISE.....	3-20
3.9 GEOLOGY AND SOILS	3-21
3.10 SOCIOECONOMICS	3-22
3.11 WATER RESOURCES	3-24
 CHAPTER 4.0 ENVIRONMENTAL CONSEQUENCES.....	 4-1
4.1 AIR QUALITY	4-6
4.1.1 Preferred Alternative.....	4-6
4.1.2 No Action Alternative.....	4-7
4.1.3 Cumulative Impacts	4-7
4.1.4 Mitigation Measures	4-7
4.2 BIOLOGICAL RESOURCES	4-7
4.2.1 Preferred Alternative.....	4-7
4.2.2 No Action Alternative.....	4-10
4.2.3 Cumulative Impacts	4-10

4.2.4 Mitigation Measures	4-11
4.3 CULTURAL RESOURCES	4-11
4.3.1 Preferred Alternative.....	4-11
4.3.2 No Action Alternative.....	4-12
4.3.3 Cumulative Impacts	4-12
4.3.4 Mitigation Measures	4-12
4.4 HAZARDOUS MATERIALS AND WASTE.....	4-13
4.4.1 Preferred Alternative.....	4-13
4.4.2 No Action Alternative.....	4-13
4.4.3 Cumulative Impacts	4-13
4.5 HEALTH AND SAFETY	4-13
4.5.1 Preferred Alternative.....	4-13
4.5.2 No Action Alternative.....	4-14
4.5.3 Cumulative Impacts	4-14
4.5.4 Mitigation Measures	4-14
4.6 INFRASTRUCTURE AND TRANSPORTATION	4-14
4.6.1 Preferred Alternative.....	4-14
4.6.2 No Action Alternative.....	4-15
4.6.3 Cumulative Impacts	4-15
4.6.4 Mitigation Measures	4-15
4.7 LAND USE.....	4-15
4.7.1 Preferred Alternative.....	4-15
4.7.2 No Action Alternative.....	4-17
4.7.3 Cumulative Impacts	4-17
4.8 NOISE.....	4-17
4.8.1 Preferred Alternative.....	4-17
4.8.2 No Action Alternative.....	4-18
4.8.3 Cumulative Impacts	4-18
4.9 GEOLOGY AND SOILS	4-18
4.9.1 Preferred Alternative.....	4-18
4.9.2 No Action Alternative.....	4-19
4.9.3 Cumulative Impacts	4-19
4.10 SOCIOECONOMICS	4-19
4.10.1 Preferred Alternative.....	4-19
4.10.2 No Action Alternative.....	4-20
4.10.3 Cumulative Impacts	4-20
4.11 WATER RESOURCES	4-20
4.11.1 Preferred Alternative.....	4-20
4.11.2 No Action Alternative.....	4-21
4.11.3 Cumulative Impacts	4-21
4.12 CUMULATIVE IMPACTS.....	4-21
4.13 INDIVIDUALS/AGENCIES RESPONSIBLE FOR OBTAINING REQUIRED PERMITS/LICENSES/ENTITLEMENTS.....	4-23
4.14 CONFLICTS WITH FEDERAL, STATE, OR LOCAL LAND USE PLANS, POLICIES, AND CONTROLS.....	4-23
4.15 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL	4-23

4.16 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL	4-23
4.17 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES	4-23
4.18 BIOLOGICAL DIVERSITY	4-23
4.19 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED.....	4-24
4.20 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY	4-25
4.21 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS	4-25
4.22 CONDITIONS NORMALLY REQUIRING AN ENVIRONMENTAL IMPACT STATEMENT	4-25
CHAPTER 5.0 CONCLUSION	5-1
CHAPTER 6.0 LIST OF PREPARERS	6-1
CHAPTER 7.0 INDIVIDUALS/AGENCIES CONSULTED	7-1
7.1 Agencies/Organizations/Individuals Sent Copies of the Assessment.....	7-1
7.2 Individuals and Agencies Contributing to the Project.....	7-1
CHAPTER 8.0 REFERENCES	8-1

LIST OF FIGURES

Figure 1-1. Redstone Arsenal Boundary Map	1-5
---	-----

LIST OF TABLES

Table 2-1 Comparison of Environmental Consequences Associated with Implementation of the May 2002 INRMP	2-5
Table 3-1 NAAQS and Alabama Ambient Air Quality Standards	3-2
Table 3-2 Breakdown of Wetland Types Located on Redstone Arsenal.....	3-10
Table 4-1 Criteria, Thresholds, and Methods for Impact Assessment.....	4-3
Table 4-2 Current Redstone Arsenal Land Use	4-16
Table 5-1 Comparison of Impacts for the Alternatives Based on Significance Criteria and Thresholds	5-2

APPENDICES

Appendix A – Correspondence From Coordinating Agencies
--

CHAPTER 1.0 INTRODUCTION

The National Environmental Policy Act (NEPA); the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508); Department of Defense (DoD) Directive 6050.1, *Environmental Effects in the United States of Department of Defense Actions* (U.S. Department of Defense, 1979); and 32 CFR Part 651, *Environmental Analysis of Army Actions*, (U.S. Department of the Army, 2002), which implements these laws and regulations, direct DoD and U.S. Army officials to consider environmental consequences when authorizing or approving federal actions. Accordingly, this Environmental Assessment (EA) analyzes the environmental consequences and benefits of implementing an Integrated Natural Resources Management Plan (INRMP) for Redstone Arsenal (RSA).

Section 1.0 of this EA discusses the background for this action, gives a brief description of the Proposed Action, introduces the purpose of and need for the action, identifies the location of the project, and highlights issues raised during the assessment process. Section 2.0 discusses project alternatives and compares the environmental consequences of the alternatives. Section 3.0 describes the affected environment of the Proposed Action. Section 4.0 assesses the potential environmental consequences of implementing the alternatives and discusses potential cumulative impacts for each resource. Section 5.0 details the conclusions of the assessment, and Section 6.0 contains a list of preparers for this EA. Section 7.0 lists the individuals and agencies consulted during the preparation of this EA and the agencies, organizations, and individuals that were sent a copy of the EA. Section 8.0 contains a list of the references used in the preparation of this document.

1.1 Background

The U.S. Army Aviation and Missile Command (AMCOM) at RSA has a history of commitment to natural resources management and follows a management philosophy that focuses on biodiversity conservation. Following this philosophy, Installation personnel have developed and implemented an ecosystem-based natural resources management program. This program pursues the following vision:

- Support the military mission;
- Manage natural resources using sound ecological principles in the appropriate landscape contexts (e.g., local, regional, and national); and
- Continue to provide opportunities for future generations to access RSA and use the Installation's natural resources.

1.1.1 Description of the Proposed Action

The Directorate of Environmental Management (DEM) proposes to manage RSA's natural resources by implementing an INRMP. The INRMP will comply with environmental laws, regulations, and policies, including Army Regulation (AR) 210-10, *Procedures for Maintaining Continuity of Essential Facilities, Engineering Functions at Army Installations*; AR 200-3, *Natural Resources Land, Forest, and Wildlife Management*; Technical Manual (TM) 5-630, *Natural Resources Land Management*; TM

5-631, *Natural Resources Forestry Management*; TM 5-632, *Military Entomology Operations Handbook*; Public Law (PL) 99-561; Department of Defense (DoD) Directive 4700.4, *Natural Resource Management Program*; and DoD Directive 4715.3, *Environmental Conservation Program*. In addition, the INRMP fulfills requirements pursuant to the Sikes Act Improvement Act (SAIA) of 1997, which is designed to “promote effectual planning, development, maintenance, and coordination of wildlife, fish, and game conservation and rehabilitations on military reservations”. The following are required by the SAIA:

- Preparation and implementation of an INRMP;
- Coordination during preparation and implementation of the INRMP with the U.S. Fish and Wildlife Service (USFWS) and the appropriate state fish and wildlife agencies;
- Mutual agreement between the military and USFWS and state agencies with respect to those elements of the INRMP that are subject to otherwise applicable legal authority (e.g., Endangered Species Act requirements);
- Opportunity for public commenting on the INRMP;
- INRMPs must contain specific projects that can be implemented on an annual basis and projected out over at least five years; and
- Frequent revisions of the INRMP to assure the Installation stays ahead of the implementation schedule.

The INRMP would be consistent with other Installation plans, including the master plan and cultural resources management plan. It would also build upon relationships established with federal, state, and local agencies; and support the military mission of the Installation. The INRMP would emphasize the continuation of RSA’s current natural resources management program. This program includes an emphasis on fostering wise use of water resources; designating conservation land-use to protect wetlands, forests and grasslands; controlling invasive/exotic vegetation; conserving and enhancing healthy native wildlife communities and endangered, threatened, and rare species by maintaining and managing the current refuges and wildlife corridors. Natural resources management would also continue to support environmental education and low-intensity outdoor recreation.

The Proposed Action included in this EA is for the implementation of an INRMP that will serve as the roadmap for the management of RSA’s natural resources for the years 2002 through 2007. As a result, the evaluation of the environmental consequences of the Proposed Action and alternatives are programmatic in nature.

The INRMP consists of four sections (I through IV). Section I contains a general description of the plan. Section II contains information pertaining to Installation land management and grounds maintenance. Section III discusses forest management, and Section IV discusses fish and wildlife management. The plan’s 26 appendices contain assorted maps and background information pertaining to the Arsenal.

The following is a brief overview of the INRMP sections. Specific baseline information pertaining to each resource area is provided in Section 3.0.

Section I - GENERAL

This section discusses Installation lands, management practices, and maintenance procedures. It contains an inventory of existing lands, and, general information pertaining to soils, flora and fauna, off-road vehicle areas, water drainage and control, soil erosion, and firebreaks. Management practices and maintenance procedures are addressed, including chemical control of vegetation, soil erosion control, prescribed burning procedures, fire protection and resource requirements. Resource requirements including personnel (both inside and outside of the organization), contract support services, equipment availability, and funding are specified.

Section II - LAND MANAGEMENT AND GROUNDS MAINTENANCE

This section discusses areas requiring grounds maintenance such as planted areas, leased agricultural lands, the golf course, cemeteries, ammunition storage areas, and the irrigation system. The management practices and maintenance procedures discussed include planting (areas and species of plants), fertilization, weed control in lawns, mowing, irrigating, ground cover plants, pruning, supervision, and disease and insect control.

Section III - FOREST MANAGEMENT

This section discusses the forest management plan for the Arsenal. A brief description of the forest lands, types, and acreages is given followed by the overall management plan. This includes a discussion of the species to be propagated; the planting and rotation cycle; the silvicultural system; timber availability, marking, harvesting, and sales; the fire protection plan; treatment of kudzu in forest stands; an annual work plan; and the management record system.

Section IV - FISH AND WILDLIFE MANAGEMENT

This section discusses the fish and wildlife management plan for the Arsenal. It includes a description of the habitats (military use of the lands, habitat types, and principal native vegetation), fish and wildlife inventories, habitat management techniques, planned projects, and funding.

1.1.2 Purpose and Need for the Action

As a guardian of public lands, it is the mission of the Arsenal's natural resources management program to maintain and improve, when feasible, the existing level of biodiversity using sound ecological principles in order to maintain the economic and aesthetic values of public lands. This effort involves ensuring Installation compliance with natural resources laws and regulations, as well as providing public access and

customer service support to Installation operations, tenants, military personnel and their families, the research and education community, and the general public.

The plan provides a framework for management of Arsenal lands that supports the military mission while assuring national policies on resource conservation prescribed by AR 210-10, AR 200-3, TM 5-630, TM 5-631, TM 5-632, PL 99-561, SAIA; DoD Directive 4700.4, and DoD Directive 4715.3.

The INRMP will be the Arsenal's plan for managing natural resources over the next five years. The purpose of this EA is to evaluate the potential effects of the natural resources management alternatives considered for RSA, and to summarize and compare the potential environmental consequences of each alternative. The Preferred Alternative supports integrated natural resources management, that is, at a minimum, in compliance with existing laws, regulations, and policies. Another purpose of this EA is to determine whether the preparation of an environmental impact statement (EIS) is required, or if a Finding of No Significant Impact (FONSI) is warranted. If this EA supports a FONSI, the Preferred Alternative will be implemented, and the INRMP will be reviewed and updated as required for mission or environmental changes.

1.1.3 Location

Redstone Arsenal is located in Madison County, Alabama, southwest of and adjacent to the City of Huntsville (Figure 1-1). Prior to acquisition by the Army, the area was used for producing cotton, corn, hay, small grain crops, and livestock. The original land was purchased in 1941-1942 from 320 landowners as part of the Siebert Arsenal Project. Under this project, the Huntsville Arsenal and Redstone Arsenal were constructed to manufacture chemical munitions. In 1949, the two arsenals were eventually integrated, creating the RSA with an approximate 32,000 acres. Over the ensuing years the size of RSA has fluctuated. Redstone Arsenal currently comprises 37,910 acres (including special-use permit land). The site is approximately six miles wide and ten miles long (U.S. Army Missile Command, 1994). The INRMP addresses RSA in its entirety.

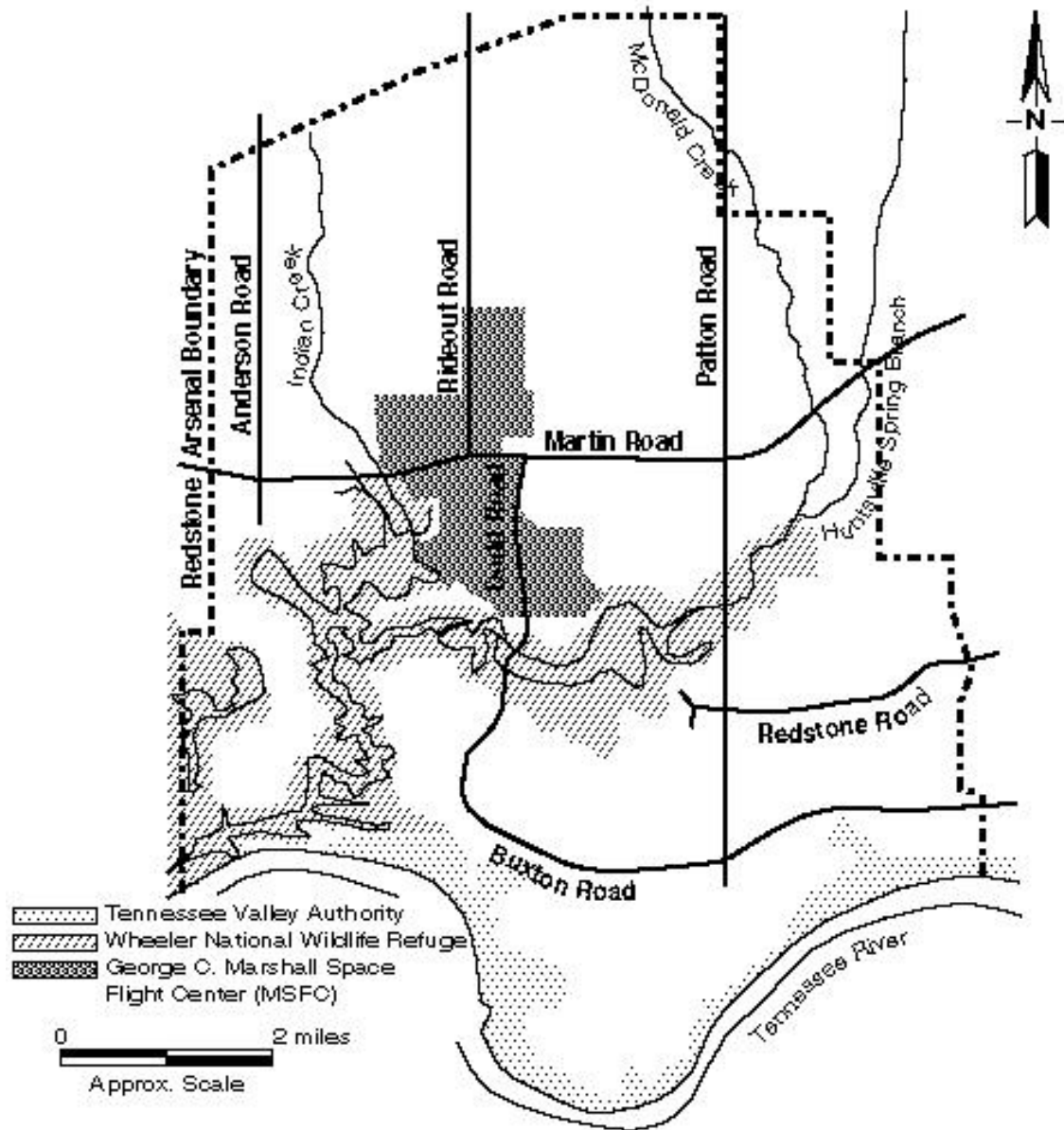


Figure 1-1. Redstone Arsenal Boundary Map

1.2 Related Environmental Documentation

A list of related environmental documentation reviewed during the preparation of this EA is shown below.

- Natural Resources Management Plan for Redstone Arsenal, Parts I, II, III, IV, May 2002.
- Final Environmental Assessment for Redstone Arsenal Master Plan Implementation, U.S. Army Missile Command, Redstone Arsenal, Alabama, December 1994.

1.3 Agencies Involved in Environmental Analysis

The Tennessee Valley Authority (TVA), the USFWS, and the Environmental Protection Agency (EPA) are the cooperating agencies for the preparation of this EA.

1.4 Public Involvement

Public involvement would take place after the completion of the draft of this EA. There would be a 30-day comment period after the Notice of Availability of the EA for the INRMP for RSA is published in the local newspaper.

All issues raised during the scoping process have been addressed by this assessment. No potentially significant environmental impacts were identified.

CHAPTER 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The National Environmental Policy Act emphasizes consideration and evaluation of reasonable alternatives to meet proposed objectives while minimizing environmental impacts. *Environmental Analysis of Army Actions* (32 CFR Part 651) recognizes the NEPA requirement for the proponent of an action to identify and describe all reasonable alternatives to a Proposed Action. The CEQ's regulations on implementing NEPA require that a No Action Alternative be included in the analysis. Each alternative other than the No Action Alternative must meet "purpose and need" objectives to be considered reasonable.

An assessment of alternative natural resources management practices and techniques for RSA must consider that the Installation has an ongoing natural resources program. The Installation has been following an ecosystem-based approach to natural resources management for several years and has entered what may be considered the next phase of management—implementation of integrated natural resources management and monitoring to determine when goals and objectives are achieved and when adaptive management may be needed.

The NEPA process allows RSA natural resource managers to utilize an interdisciplinary approach in planning and in decision-making. It also provides an opportunity to objectively examine and compare various alternative approaches to natural resources management to facilitate the decision-making process. Natural resources management practices in the United States have been dictated in part by historical needs for and uses of the land and its resources. Changing attitudes to management have been driven by many issues including social, economic, and political, as well as by increases in scientific knowledge and understanding of the environment. Because of our improved understanding of the interrelatedness of natural resource systems, we are more aware today of the potential threats to the natural systems that we depend on.

2.1 Summary of Alternatives

As part of the NEPA process, two alternatives were identified that could potentially provide a full range of options to natural resource managers. The No Action Alternative would result in a basic ecosystem management approach, and the Preferred Alternative would result in ecosystem management under an integrated natural resources management approach. Although the No Action Alternative follows a basic ecosystem approach, it is not integrated through an INRMP as required by the SAIA. Besides being required by the CEQ, the No Action Alternative is presented in this EA because it provides a baseline for comparison of the other alternative and does follow an acceptable approach within a range of management approaches.

2.2 Description of Alternatives

The two identified alternatives for the Proposed Action that are described below and that are carried through the NEPA process include the following:

- Preferred Alternative: Integrated ecosystem management under an INRMP
- No Action Alternative: Basic ecosystem management

2.2.1 Preferred Alternative – Integrated Ecosystem Management

This integrated ecosystem management alternative emphasizes a comprehensive and integrated approach to natural resources management. It considers all of the available baseline studies and surveys that RSA has completed in preparation for implementation of ecosystem management practices. Many ongoing initiatives and actions that would occur under the No Action Alternative would continue or advance to the next phase of implementation. The integrated plan that would be implemented under this alternative includes the specific goals and objectives for key resource management areas. These resource areas include the following:

- Forest management
- Fish and wildlife management
- Water resources management
- Wetland management
- Unimproved grounds vegetation management
- Improved grounds vegetation management
- Endangered, threatened, and special concern species management

Under this alternative, implementation of the INRMP is not just the responsibility of RSA's Directorate of Environmental Management, but rather the various offices and directorates on the Arsenal would also have a role in the plan's implementation. Redstone Arsenal lands would continue to fully support the Army's military mission and comply fully with Army and general DoD guidance and regulations concerning natural resources management. Elements of multiple and mixed-use practices are retained, and additional objectives are included under this integrated ecosystem management alternative.

Forest Management under the INRMP would provide, to the extent possible, a plan consistent with the mission of the Installation for the orderly, scientific management of Installation woodlands to:

- conserve and protect natural resources;
- properly maintain military grounds;
- protect the real estate investment of the Government from depreciation, exploitation, and depletion;
- facilitate the military mission;
- produce optimum forest products needed by the local and national economy; and

- safeguard downstream property from flood and erosion damage. (AMCOM, 2002b)

The objectives of fish and wildlife management under this alternative are to provide:

- a diverse assemblage of habitat components for the benefit of both game and non-game species;
- annual and long range plans for the maintenance and development of fish and wildlife habitat;
- integration of fish and wildlife management practices with other natural resources management work, with emphasis on multiple use concepts;
- wetland management strategies to enhance and promote ecosystem integrity;
- development and implementation of management strategies to enhance the populations of endangered and threatened fish and wildlife species;
- recreational hunting and angling opportunities while achieving optimum sustained yield and complying with established federal and state regulations; and
- identification and development of opportunities for nonconsumptive use of natural resources within RSA's boundaries.

2.2.2 No Action Alternative—Basic Ecosystem Management

By definition, the No Action Alternative for the Proposed Action would be the continued implementation of the overall program philosophy and practices under the existing natural resources program. Under the No Action Alternative, RSA would continue to embrace biodiversity conservation and would continue to implement an ecosystem-based natural resources management program. Ongoing management practices would continue. In general, RSA's natural resources management program is not based on single-species management. Consistent with the principles of ecosystem management, RSA would continue to manage lands in a manner that promotes preservation and enhancement of native communities and the existing diversity of species within communities.

The No Action Alternative would also mean that individual Installation plans used to support current natural resources management (i.e., cultural resources management plan, fire protection plan, etc.) would be implemented on an individual, stand-alone basis. This alternative was not considered viable because it lacks a fully integrated approach and does not include preparation and implementation of an INRMP as required by the SAIA. However, although the No Action Alternative is not considered to be fully integrated, RSA's current management philosophies and many of their practices are valid and would be continued.

2.3 Comparison of Environmental Consequences

This section discusses the environmental consequences of the alternatives considered within this EA. The CEQ's regulations for implementing NEPA (40 CFR Part 1508.27) require that the context and intensity of an impact or effect be considered to determine the significance of the impact. Significance can vary in relation to the context of the chosen alternative of the Proposed Action. Context may include considering the effects on a national, regional, or local basis. Both short- and long-term effects may be relevant.

Impacts are also evaluated in terms of their intensity or severity. Factors contributing to this intensity or severity include the following:

- The degree to which the action affects public health or safety;
- Unique characteristics of the geographic area such as proximity to cultural resources, public lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas;
- The degree to which effects of the action on the quality of the human environment are likely to be highly uncertain or controversial;
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration;
- Whether the action is related to other actions with individually insignificant, but cumulatively significant, impacts;
- The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places (NRHP) or may cause loss or destruction of significant scientific or cultural resources;
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA); and
- Whether the action threatens to violate a federal, state, or local law or requirements imposed for environmental protection.

Table 2-1 provides a comparison of the environmental consequences associated with the implementation of the alternatives by individual resource. The information presented in Table 2-1 is based on the environmental impacts analysis presented in Section 4.0 of this EA. As outlined in Section 4.0, three levels of impact are defined.

- No Impact - No impact is predicted.
- No Significant Impact - An impact is predicted, but the impact does not meet the intensity/context significance criteria for the specific resource.
- Significant Impact - An impact is predicted that meets the intensity/context significance criteria for the specific resource.

If the Preferred Alternative were selected, RSA would implement the updated INRMP (May 2002) in a timely and effective manner. This INRMP would provide an inventory of natural resources and outline procedures for managing soil, timber, fish and wildlife, and grassland for the benefit of resident fish and wildlife resources on the Arsenal. The plan would serve as a guide for developing and maintaining Arsenal lands consistent with the military mission and national policies on conservation of resources.

The Preferred Alternative to the Proposed Action would have several beneficial impacts to the environment. The plan should have positive impacts to biological resources, cultural resources, health and safety, infrastructure and transportation, land use, geology and soils, socioeconomics, and water resources. Resource areas where no significant impacts are expected include air quality, hazardous materials and waste, and noise.

**Table 2-1. Comparison of Environmental Consequences
Associated with Implementation of the May 2002 INRMP**

RESOURCE	PREFERRED ALTERNATIVE	NO-ACTION ALTERNATIVE
Air Quality	X	X
Biological Resources	+	+
Cultural Resources	+	+
Hazardous Materials and Waste	X	X
Health and Safety	+	+
Infrastructure and Transportation	+	+
Land Use	+	+
Noise	X	X
Geology and Soils	+	+
Socioeconomics	+	+
Water Resources	+	+

-- No Impact

X No Significant Impact

+ Positive Impact

If the No Action alternative were selected, basic ecosystem management would continue. No significant impacts would be anticipated to occur, although the natural resources program would not be in compliance with the SAIA because it would lack an INRMP.

CHAPTER 3.0 AFFECTED ENVIRONMENT

This section describes the environmental characteristics that may be affected by the Proposed Action. The affected environment is described in order to provide a context for understanding the potential impacts. Those components of the affected environment that are of greater concern relevant to the potential impacts are described in greater detail.

Eleven broad environmental components were considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the significance of potential impacts. Federal and/or state environmental statutes, many of which set specific guidelines, regulations, and standards, regulate several of these environmental components. These standards provide a benchmark that assists in determining the significance of environmental impacts under the NEPA evaluation process. The compliance status of each project area with respect to environmental requirements was included in the information collected on the affected environment. The areas of environmental consideration are air quality, biological resources, cultural resources, hazardous materials and waste, health and safety, infrastructure and transportation, land use, noise, geology and soils, socioeconomics, and water resources.

3.1 AIR QUALITY

The Air Quality Act of 1967, commonly referred to as the Clean Air Act (CAA), was designed to protect and enhance the quality of the Nation's air resources. This Act, along with amendments adopted in 1970, 1977, and 1990, serves as the basis for air quality standards. The National Ambient Air Quality Standards (NAAQS), which were established by the EPA and mandated by the CAA, are the standards for ambient concentrations of the criteria pollutants: sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), ozone (O₃), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM-10), and lead (Pb). The NAAQS concentrations are ceilings that may not be exceeded. The NAAQS and Alabama Air Quality Standards are shown in Table 3-1. Areas are classified in one of three categories:

- Attainment - better air quality than required by standards;
- Non-attainment - worse air quality than required by standards; and
- Attainment unclassified - insufficient data available for the area to warrant non-attainment status and justify attainment status.

The NAAQS have been adopted by the State of Alabama and the City of Huntsville. Redstone Arsenal is located in Madison County, which is in the Tennessee River Valley - Cumberland Mountains Air Quality Control Region. The Madison County area has an attainment unclassified designation for all primary and secondary pollutant standards stipulated under the NAAQS. (U.S. Army Missile Command, 1994)

Table 3-1. NAAQS and Alabama Ambient Air Quality Standards (Same Values)

Pollutants	Averaging Period	Primary Ambient Air Quality Standards (µg/m3)	Secondary Standard (µg/m3)
Sulfur Dioxide	3 hours	---	1,300
	24 hours	365	---
	Annual	80	---
Particulates < 2.5 µm (PM-2.5)	24 hours	65	65
	Annual	15	15
Particulates < 10 µm (PM-10)	24 hours	150	150
	Annual	50	50
Carbon Monoxide	1 hour	40,000	---
	8 hours	10,000	---
Ozone	8 hours	157	157
Nitrogen Dioxide	Annual	100	100
Lead	Calendar quarterly mean	1.5	1.5

The State of Alabama issues air permits for RSA. Operations subject to air permit regulations include boilers, petroleum storage tanks, and a propellant sparging unit. Each permitted emission source on RSA is in compliance with the terms of the permit. (U.S. Army Missile Command, 1994)

Redstone Arsenal has an established contract for refuse disposal at the Waste-to-Energy Plant operated adjacent to the Arsenal by the City of Huntsville. The City is responsible for air emission permitting and compliance of the facility. The plant burns up to 690 tons of waste per day including household, industrial, and commercial waste. Hazardous or contaminated wastes are not accepted. (U.S. Army Missile Command, 1994)

There are approximately 34,000 privately owned vehicles transporting employees onto RSA daily. No state or local requirements for emissions testing of these vehicles exist. In recent years, traffic delays and tie-ups during peak hours have become noticeable. This situation results in increased vehicle emissions; however, air quality monitoring has not identified automotive emissions as presenting an impact to meeting attainment standards in the region. (U.S. Army Missile Command, 1994)

Approximately 2,000 acres of open ranges and forests are programmed for burning each year in coordination with the Arsenal's Environmental and Fire Protection offices and

mission user personnel. This prescribed burning is conducted in accordance with AR 200-3 and TM 5-631. (U.S. Army Missile Command, 1994)

Prescribed Burning Procedures are designed to ensure compliance with federal, state, and local requirements by specifying coordination with RSA's Directorate of Environmental Management, local weather stations (to ensure acceptable weather conditions), City of Huntsville Natural Resources Office, Alabama Forestry Commission (to obtain Burn Permit, if required), and AMCOM Emergency Operations, Environmental Staff, Public Affairs, Provost Marshal, Range Operations Office, and Fire Department (that grants final approval for burning).

3.2 BIOLOGICAL RESOURCES

This section describes biological resources by major biotic habitat. Special-status species (e.g., federally listed and species of concern) and species with unique habitats are also addressed. Information in this section is derived from existing documentation and has not been field verified.

Terrestrial and aquatic resources on the Arsenal include vegetation and wildlife communities in a variety of ecological associations. Several federal agencies oversee various aspects of biological resource management. The Endangered Species Act (ESA) declares that it is the policy of Congress that all federal departments and agencies shall seek to conserve threatened and endangered species. Further, the act directs federal agencies to use their authority in furtherance of the purposes of the ESA.

VEGETATIVE COMMUNITIES

Redstone Arsenal is a continuous tract of land encompassing approximately 38,000 acres, with a varied topography and diverse assemblage of vegetation communities. Elevations range from approximately 560 feet above mean sea level (MSL) in bottomlands to 1,200 feet above MSL in the mountainous regions of the Installation. Forest lands, rights-of-way, test areas, old-fields (abandoned open areas) in various stages of plant succession, in addition to developed areas, creeks, sloughs, and ponds serve as habitat for numerous fish and wildlife species.

Common Plants

Redstone supports the following common native, non-native, and invasive plant species:

- Trees and shrubs: pines (*Pinus spp.*), hickories (*Carya spp.*), oaks (*Quercus spp.*), elms (*Ulmus spp.*), maples (*Acer spp.*), ashes (*Fraxinus spp.*), eastern redcedar (*Juniperus virginiana*), yellow poplar (*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), flowering dogwood (*Cornus florida*), sumacs (*Rhus spp.*), and privet (*Ligustrum sp.*).

- Vines: greenbrier (*Smilax* spp.), kudzu (*Pueraria lobata*), poison ivy (*Rhus radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and Japanese honeysuckle (*Lonicera japonica*).
- Herbaceous plants: pokeweed (*Phytolacca americana*), beggarweed (*Desmodium* spp.), and lespedezas (*Lespedeza* spp.).
- Common grasses: broomsedge (*Andropogon* spp.), cane (*Arundinaria* spp.), paspalum grass (*Paspalum* spp.), fescue (*Festuca* sp.), and plume grass (*Erianthus* sp.).
- Aquatic and marsh plants: smartweed (*Polygonum* spp.), cattail (*Typha* spp.), duckweed (*Lemna* sp. and *Spirodela* sp.), coontail (*Ceratophyllum* sp.), parrot feather (*Myriophyllum brasiliensis*), water primrose (*Ludwigia* sp.), lizard's tail (*Saururus* spp.), American lotus (*Nelumbo lutea*), jewel weed (*Impatiens capensis*), sedges (*Carex* spp.), and rushes (*Juncus* spp.).

Non-forest Lands Non-forest lands include improved areas, semi-improved areas, unimproved areas, and eroded areas. Hay and pasture lands encompass approximately 3,972 acres. The remaining 13,301 acres are comprised of fallow fields, wetlands, and improved and semi-improved grounds. On the improved areas and lawns, a number of grasses have been planted including common Bermuda (*Cynodon dactylon*), Tifton Bermuda, zoysia (*Zoysia* spp.), fescue, and white clover (*Trifolium repens*). Species planted on earth covered storage magazines (semi-improved areas) are selected for appearance and maximum erosion control. In the past, these have been Bermuda grass and in remote areas, *Sericea lespedeza*, and kudzu. In those areas planted with kudzu, it has grown uncontrollably and covers approximately 2,000 acres. On the roadsides, Kentucky 31 tall fescue, southern white clover, zoysia, and Bermuda grass have been used. The golf course was established using springs of Tifton 328 Bermuda, fairways were seeded to common Bermuda, and roughs seeded to fescue.

Trees used in landscape plantings have been pin oak, various species of maples, southern magnolia, dogwood, white pine, redbud, various species of locust, sycamore, ginkgo, weeping willow, white ash, and loblolly pine. Ornamental plantings have included saucer magnolia, crepe myrtle, crabapple, and Japanese maple.

Shrubs planted have been Chinese holly, Buford holly, Foster holly, Japanese holly, azalea, junipers, nandina, wax leaf viburnum, photenia, abelia, yaupon, sweet olive, Winterberry, barberry, leather leaf viburnum, gold bell, was leaf ligustrum, and pyracantha. Ground cover includes kudzu, honeysuckle, periwinkle, creeping phlox, creeping red sedum, barrenwort, bugleweed, coralberry, cotoneaster, cowberry, creeping lilyturf, creeping thyme, crownvetch, daylily, and English ivy.

Redstone Arsenal has 3,769 acres of agricultural leased land. The leased unit may be used for the production of hay crops with grass and legume species such as fescue, clover, timothy, alfalfa, and Bermuda grass and certain small grain species such as wheat, rye, sorghum, oats, barley, or triticale.

Forest Lands Forested land consisting of hardwoods, pines, and mixtures of the types are distributed across 41 percent of the 37,910 acre landscape. Elevations range from 556 to 1,239 feet MSL. More than 15,000 acres of RSA is susceptible to a 100-year flood from the Tennessee River and its on-post tributaries (AMCOM, 1999).

According to the RSA forest inventory, 15,656 acres are covered in forest. This figure is broken down into approximately 4,627 acres as pines; 8,531 acres as hardwoods; 1,994 acres as mixed pine-hardwoods; and 504 acres as mixed cedar-pine-hardwoods.

The forest is temperate and composed of over 100 tree and shrub species, of which 21 tree species are designated as potential commercial forest product species. Four major forest types are distributed over a landscape ranging from river bottomland floodplains and gently sloping uplands to steep, mountainous karst topography. The major upland forest types are natural and plantation pine, pine/hardwood, hardwood, and eastern redcedar/hardwood. The upland forest trees are largely eastern redcedar; loblolly pine; northern red, black, white, chinquapin, southern red, scarlet, post and chestnut oaks; white ash; mockernut, pignut, and shagbark hickories; and black locust. Understory trees on upland sites include the redbud, flowering dogwood, possumhaw, Carolina buckthorn, hophornbeam, shining sumac, and winged elm (Weber, 2002).

The lowlands are dominated by oaks in the more isolated wetland flats, and by a mixture of trees in floodplains and along karst basins. From those species more likely to be found in shallow swamps to the upper limits of flood, the species include water tupelo, water hickory, swamp privet, willow, overcup oak, willow oak, sycamore, river birch, red maple, sweetgum, swamp chestnut oak, sugarberry, water oak, cherrybark oak, blue beech, beech, and tulip poplar. Understory trees include silky dogwood, deciduous holly, storax, clammy azalea, hawthorns, and buttonbush. Ground covers are quite varied depending on the overstory, but in ecotones where sunlight penetrates, peppervine, poison ivy, false nettle, lizard's tail, Virginia creeper, crossvine, trumpet creeper, supplejack, blackberry, and greenbriar's are common. (Weber, 2002)

Pine stands located on the Installation are generally dominated by Loblolly pine with some shortleaf pine. Most of the older pine stands are very dense with minimal ground cover with the exception of several stands that are extensively covered with kudzu. Where ample sunlight reaches the forest floor a variety of understory vegetation flourishes including box elder, blackberry, greenbriar, sassafras, smooth and winged sumacs, honey and black locust, wild grape, and a variety of seedling oaks. Herbaceous flora is an important component of these pine stands, where conditions allow, and are dominated by Japanese honeysuckle, poison ivy, broomsedge, and various grasses. As mentioned above, an estimated 2,000 acres of the open forested land is covered with kudzu that seriously threatens the natural vegetation and diversity of these areas.

Forest cover types are associated with topography and soil types. In general, pure hardwood stands are found in low-lying wetland areas where soils are saturated with water much of the time. A few large hardwood stands exist on rocky mountainous slopes. Pines are distributed over well-drained low ridges and in some of the low areas. Cedar stands and cedar mixed with hardwoods make up the predominant land cover upon

limestone outcrops on mountain slopes. A detailed forest inventory entitled *Redstone Arsenal, Alabama, Inventory and Cover Type Data* was prepared by Mississippi State University in 1999.

Limited logging operations on the Arsenal occurred prior to 1953. The first major logging activities were carried out in 1953 and 1954 for range clearing requirements. Professionally planned timber harvesting by annual government sales began in 1958. The first forest management plan was implemented in 1970 and prescribed forest management activities to ensure optimum resource management. (U.S. Army Missile Command, 1994)

Currently, forested areas are being managed for multiple uses. The goal is to provide optimum wildlife habitat (for both game and non-game species) and quality timber production while supporting military mission requirements at the Arsenal. An uneven-age management scheme is used for the Arsenal's forested areas. This allows pine trees to be selectively harvested from targeted areas with minimum impacts to the wildlife habitat. At present no hardwood cuts are being performed on the Arsenal with the exception of cuts needed for construction or mission goals because of the fragile soil and ecosystem characteristics of the hardwood stands. No hardwood acreage is being converted to pine acreage on the Arsenal, and formerly leased and open land is being reforested at a rate of approximately 100 acres per year. Management with minimal harvests in hardwood stands (primarily for construction to support mission needs) will provide optimum habitat for wildlife (game and non-game) and neotropical songbirds and associated plant and animal species. (Horton, 2002)

The forested lands on the Arsenal are divided into 22 compartments for the purpose of management planning. Boundaries are delineated on the ground by roads, fire trails, natural openings, fences, and streams. Compartments of Regulated Commercial Forest Land are numbered 1 through 12, and Compartments of Modified Commercial Forest Land are lettered A through K. Each compartment is further broken down into forest stands to assist in planning the management and harvesting operations. Stands range in size from 4 to 400 acres. (U.S. Army Missile Command, 1994)

The cutting cycle (interval between harvests), selected to thin and harvest timber stands to reach full stocking or the desired basal area, is 9 to 12 years for two intermediate pulpwood thinnings and one sawtimber thinning before rotation. An overall three-year schedule has been adopted for the entire forest resource to provide the opportunity to perform other forest improvement activities (e.g. prescribed burning) and provide the latitude to harvest priority stands and stay within the cutting cycle. (Horton, 2002)

The target basal areas for remaining forested stands (pines), after the first and second thinning cuts, is 70 to 90 ft²/acre. The target basal area remaining after intermediate sawtimber and pulpwood cuts is 50 ft²/acre. During the final rotation the desired basal area remaining should be about 30 ft²/acre. For areas suitable for seed trees and shelterwood a basal area of 50 ft²/acre may be desired. (Horton, 2002)

The annual allowable harvest of forested areas is calculated based on current volumes and stocking levels for predominantly pine and mixed pine/hardwood stands for each compartment. For the next five years the annual allowable harvest is: pine pulpwood, 4,000 cords (CD); pine sawtimber, 1,500 thousand board feet (MBF); hardwood pulpwood, 400 CD; hardwood sawtimber, 110 MBF; and cedar pulpwood, 20 CD. Over the past five years between 400 and 500 acres of forest (primarily pine) have been harvested annually. Harvests have been aimed at reducing many of the overstocked pine timber stands to put them in condition to grow good quality timber. (Horton, 2002)

Ecotones are areas of transition between two communities (field fencelines when grown up provide a small ecotone). Ecotones can be established by leaving strips of land from 15 to 60 feet wide along field edges, fence lines, or within forested areas. Ecotones increase habitat diversity and serve as field dividers. Approximately 78 miles of constructed firebreaks are located on the Arsenal. Firebreaks can also create sharp ecotones between forest and field. These breaks average 10 feet in width and are used to impede progress of fires and as trails to transport fire fighting equipment to otherwise inaccessible areas. All are maintained by disking or mowing. Several areas subject to erosion are planted to wildlife food species. (U. S. Army Missile Command, 1994)

Approximately 1,300 acres of open range land are burned annually to reduce fire hazards on the ranges. An additional 700 acres of forested areas are burned on a three year rotational cycle to allow the understory vegetation to provide the food and cover necessary for wildlife. The total acreage burned each year is determined in coordination with the Arsenal's Natural Resources, Environmental and Fire Protection offices and mission user personnel.

Prescribed burning is essential for maintaining wildlife and bird nesting cover and providing legume seed supplies. Prescribed burning can open park-like stands, maintain natural openings, and renew herbaceous vegetation. When these areas are interspersed with numerous small streams or branch bottoms, ravines, and scrub oak ridges, opportunities for management are unlimited.

Prescribed Burning Procedures at Redstone Arsenal are designed to ensure compliance with federal, state, and local requirements by specifying coordination with the local Weather Station (to ensure acceptable weather conditions), City of Huntsville Natural Resources Office, Alabama Forestry Commission (to obtain Burn Permit, if required), AMCOM Directorate of Environmental Management, Emergency Operations, Public Affairs, Provost Marshal, Range Operations Office, and the Fire Department (that grants final approval for burning).

A more complete listing of the native vegetation within Redstone Arsenal boundaries is found in Appendix B of the *Integrated Natural Resources Management Plan for Redstone Arsenal*, May 2002.

FISH AND WILDLIFE COMMUNITIES

Some of the most common mammals on RSA and WNWR (approximately 4,085 acres of which are located on the Installation) are white-tailed deer, beaver, eastern cottontail rabbit, swamp rabbit, gray squirrel, fox squirrel, striped skunk, red bat, woodchuck, muskrat, opossum, raccoon, red and gray foxes, and coyote (U. S. Army Missile Command, 1994; Weber 1996). A more comprehensive listing of mammals occurring on or in the vicinity of the Arsenal is given in Appendix Y of the INRMP.

Over 100 bird species have been identified in RSA habitats. Over twelve neotropical migrant birds with Partners-in-Flight ratings of 19 or more were recorded in RAS forests. Some of the more common resident birds of the Arsenal include: northern bobwhite, mourning dove, downy woodpecker, hairy woodpecker, pileated woodpecker, tufted titmouse, Carolina chickadee, Carolina wren, European starling, northern cardinal, rufous-sided towhee, and house sparrow. Birds commonly seen on the Arsenal in the summer and winter include: wood duck, killdeer, American kestrel, mourning dove, great blue heron, common barn owl, eastern screech owl, belted kingfisher, red-bellied woodpecker, northern flicker, blue jay, eastern bluebird, northern mockingbird, brown thrasher, pine warbler, and field sparrow. Some of the more common aquatic birds known to nest on the Arsenal are: mallard, wood duck, and black ducks. Common migrant birds observed on the Arsenal include: Canada goose, mallard, American black duck, and American coot. (U.S. Army Missile Command, 1994). A more comprehensive listing of birds occurring on or in the vicinity of Redstone Arsenal including WNWR is presented in Appendix Y of the INRMP.

There are over one hundred species of fish found in Installation waters. Roughly half of these are considered to be abundant or common (U.S. Army Missile Command, 1994) and include: spotted gar (*Lepisosteus oculatus*), longnose gar (*Lepisosteus osseus*), skipjack herring (*Alosa chrysochloris*), gizzard shad (*Dorosoma cepedianum*), threadfin shad (*Dorosoma petenense*), chain pickerel (*Esox niger*), stoneroller (*Camptostoma anomalum*), common carp (*Cyprinus carpio*), golden shiner (*Notemigonus crysoleucas*), striped shiner (*Notropis chrysocephalus*), bluntnose minnow (*Pimephales notatus*), creek chub (*Semotilus atromaculatus*), small-mouth buffalo (*Ictiobus bubalus*), black redhorse (*Moxostoma duquesnei*), golden redhorse (*Moxostoma erythrurum*), blue catfish (*Ictalurus furcatus*), black bullhead (*Ictalurus melas*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), mosquitofish (*Gambusia affinis*), green sunfish (*Lepomis cyanellus*), warmouth (*Lepomis gulosus*), bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis megalotis*), redear sunfish (*Lepomis microlophus*), largemouth bass (*Micropterus salmoides*), and freshwater drum (*Aplodinotus grunniens*).

Reptile and amphibian species are well represented on Arsenal and WNWR lands. Fifty-one species of reptiles and twenty-nine species of amphibians are known to be present in the vicinity. Some of the more common species encountered are: American toad (*Bufo americanus americanus*), northern spring peeper (*Hyla crucifer crucifer*), upland chorus frog (*Pseudacris triseriata feriarum*), green frog (*Rana clamitans melanota*), spotted

salamander (*Ambystoma maculatum*), dusky salamander (*Desmognathus fuscus fuscus*), ground skink (*Scinella laterale*), northern black racer (*Coluber constrictor constrictor*), corn snake (*Elaphe guttata guttata*), gray rat snake (*Elaphe obsoleta spiloides*), eastern garter snake (*Thamnophis sirtalis sirtalis*), common snapping turtle (*Chelydra serpentina serpentina*), southern painted turtle (*Chrysemys picta dorsalis*), red-eared turtle (*Chrysemys scripta elegans*), eastern box turtle (*Terrapene carolina carolina*), and common musk turtle (*Sternotherus odoratus*).

WETLANDS

For an area to be classified as a Clean Water Act (Section 404 [b]) jurisdictional wetland, evidence of three parameters is required (U. S. Army Corps of Engineers, 1987). These parameters are the presence of hydrophytic vegetation, hydric soils, and wetland hydrology. Hydrophytic vegetation can be described as plant life growing in water or in a substrate that is, at least periodically, deficient in oxygen as a result of excessive water content. Hydric soils are soils that have been saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in their uppermost layer. Wetland hydrology requires that the potential wetland area be inundated or have a water table within inches of the ground surface for a specified period.

National Wetlands Inventory (NWI) maps for wetland types in Madison County were prepared by the USFWS. These non-jurisdictional maps were constructed from photo interpretations of aerial photography and were field verified by spot ground truthing. The wetland acreages cited in this EA were derived primarily from these NWI maps. Work completed by Geonex Corporation (1995) reports the total wetland acreage of the Arsenal to be 9,889.5 acres. Table 3-2 provides a summary of the wetlands and acreage by major wetland type within the Installation boundary.

Wetlands on RSA are home to a large number and variety of plant and animal species. About 20 percent of the Installation is covered by wetlands. The wetlands are mostly associated with creeks or spring runs that are easily affected by the elevation of the Tennessee River (Weber, 1996) and have bottomland hardwood forests associated with the Tennessee River and its major tributaries. The area of palustrine emergent wetland type on the Arsenal is relatively small.

Wetlands are among the most biologically productive natural ecosystems in the world, comparable to tropical rain forests and coral reefs in the number and diversity of species they support. Wetlands produce great volumes of food as leaves and stems break down in the water to form detritus. This enriched material is the principal food for many aquatic invertebrates and forage fish that are food for larger commercial and recreational fish species.

Wetlands are critical to the survival of a wide variety of animals and plants, including numerous threatened and endangered species. For many species such as the wood duck, muskrat and swamp rose, wetlands are primary habitats. For others, wetlands provide important seasonal habitats where food, water and cover are plentiful.

Table 3-2 Breakdown of Wetland Types Located on Redstone Arsenal

Wetland Type	Acreage (rounded to nearest 1/10 acre)
Palustrine emergent (PEM)	1,213.7
Palustrine forested (PFO)	6,381.7
Palustrine aquatic beds (PAB)	2.4
Palustrine scrub-shrub (PSS)	1,057.6
Palustrine unconsolidated bottoms (PUB)	62.8
Palustrine unconsolidated shoreline (PUS)	7.0
Palustrine overlapping types (Pmulti)	400.3
Lacustrine types (all)	668.5
Riverine/Stream types (all)	95.5
Total	9,889.5 acres

Source: Geonex, 1995

In their natural condition, wetlands often provide many benefits, including food and habitat for fish and wildlife, flood protection, shoreline erosion control, natural products for human use, water quality improvement, and opportunities for recreation, education and research.

About half of the Arsenal wetlands are under WNWR jurisdiction. Redstone Arsenal's obligation is to oversee construction projects near any wetlands and to provide protection for both WNWR and Installation wetlands and mitigate any problems caused by construction in these areas.

AQUATIC RESOURCES

Redstone Arsenal is located on the north bank of the Tennessee River about 46 miles above Wheeler Dam and 17 miles downstream from Guntersville Dam. Over 10,000 acres of the Arsenal are affected by high stages of the Tennessee River and other tributary streams. (U. S. Army Missile Command, 1994) Huntsville Spring Branch, with a drainage area of 86 square miles, flows southward through the City of Huntsville to enter the northeast corner of the Arsenal; from there it flows southwestward to join Indian Creek, a tributary of the Tennessee River. Indian Creek, which enters the western edge of the Arsenal, drains an area of 143 square miles. It joins the Tennessee River at mile 321. Indian Creek extends upstream through gently rolling topography with relatively little built-up area containing pasture land, strip-cropping, and wooded areas. Conversely, Huntsville Spring Branch, traverses low swampy areas on the Arsenal and then encounters a major drainage area for the City of Huntsville. In addition, Huntsville Spring Branch receives run-off from wooded mountain sides, open pasture or strip-crops within the watershed surrounding Huntsville. The normal pool of Wheeler Lake, at

elevation 556, backs into the reservation to form permanent pools of 680 and 575 acres, at the lower end of these streams. Within the Installation boundaries, Indian Creek drains approximately 12,000 acres and Huntsville Spring Branch drains approximately 11,000 acres. The southern portion of the Installation drains into the Tennessee River through smaller channels and approximately 2,000 acres, located south of Madkin Mountain, drains into outlets constructed in conjunction with Fowler Road.

Ponds located on the Arsenal are the result of gravel excavations or quarrying operations, or are of natural origin. Some ponds are in karst basins (limestone eroded by groundwater) and others are beaver ponds. Streams have been contaminated from various sources within the watershed. Huntsville Spring Branch and Indian Creek are the largest waterways traversing the Installation and both are tributaries to the Tennessee River.

A range of aquatic habitat types is present on RSA from small ponds and quarry pits to the Tennessee River. Little documentation of the biological characteristics of these aquatic systems exists. As much as 10,000 acres of Installation property can be affected by flood stages of the Tennessee River and its associated tributaries. The Fish and Wildlife Species Inventories provide a listing of fish species whose ranges include the Arsenal and WNWR is given in Appendix F of the *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation*, December 1994. This document also contains a listing of aquatic invertebrate species collected in Huntsville Spring Branch and Indian Creek during long-term monitoring of these streams.

THREATENED AND ENDANGERED SPECIES

Biological resources warranting special protection include federally threatened and endangered species. Under the ESA, federal agencies are prohibited from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival.

Alabama ranks fifth in the nation (after California, Texas, Hawaii, and Florida) in the number of federally listed endangered and threatened plants and animals and is first in total extinctions. Since much of the Arsenal's lands have not been developed, the potential for encountering rare species is high.

Animals

The following sensitive animal species (including state-protected and federal-listed species) occupy or migrate through RSA according to the Installation's Endangered Species Management Plan, 2002:

- Gray Bat (*Myotis grisescens*) and Alabama Cave Shrimp (*Palaeomonias alabamiae*), federal-endangered and state-protected, are residents;
- Bald eagle (*Haliaeetus leucocephalus*), federal-threatened and state-protected and the peregrine falcon (*Falco peregrinus anatum*), formerly federal-endangered and currently state-protected, are seasonally present (migratory);

- American alligator (*Alligator mississippiensis*) was introduced to RSA and is listed as a federal-threatened species due to its similarity in appearance to the American crocodile (*Crocodylus acutus*), and is a resident;
- Tuscumbia darter (*Etheostoma tuscumbia*), federal species of concern, is a resident;
- Green salamander (*Aneides aeneus*) and southern cavefish (*Typhlichthys subterraneus*), state protected species, are residents;
- Cave crayfish (*Oronectes australis australis*), northern long-eared myotis (*Myotis septentrionalis*), and solitary vireo (*Vireo solitarius*), globally sensitive, are residents.

The following sensitive plant species (including state-protected and federal-listed species), occupy RSA according to the 2002 Endangered Species Management Plan:

- Price's potato bean (*Apios priceana*), federal-threatened;
- Ginseng (*Panax quinquefolius*), regulated by state permit;
- Dwarf trillium (*Trillium pusillum alabamicum*) and Harper's umbrella plant (*Eriogonum longifolium harperi*); federal species of concern and state-protected;
- Cumberland rosinweed (*Silphium brachiatum*), state-protected; and
- Limestone adder's tongue (*Ophioglossum engelmannii*), pinesap (*Monotropa hypopithys*), featherfoil (*Hottonia inflata*), Michaux's glade cress (*Leavenworthia uniflora*); and Elliott's fan petal (*Sida elliotii*), globally sensitive.

UNIQUE HABITATS

Biological resources warranting special protection include species that occupy unique habitats. There are numerous locations throughout RSA that fall under these categories (Alabama Natural Heritage Program, 1995).

Aquatic Cave Communities

There are 22 caves on the Arsenal, but not all of them are mapped (Weber, 1996). These caves offer unique habitat for several species of animals, some of which are federally listed as endangered or of special concern in the State of Alabama. The best examples of this community type are Bobcat and Matthews Caves. Both caves have extensive underground aquatic habitats. Rubble and breakdown of rocks on the mud floor provide numerous crevices and interstices for the small invertebrate and vertebrate fauna.

Dominant animal species found in aquatic caves on the Arsenal include: amphipods (*Stygobromus* spp., *Gammarus* spp.), isopods (*Caecidotea* spp.), and the cave salamander (*Eurycea lucifuga*). Also found are rarer species such as: cave crayfish (*Orconectes australis australis*), Alabama cave shrimp (*Palaemonias alabamae*), and southern cavefish (*Typhlichthys subterraneus*).

Terrestrial Cave Communities

Several examples of this community type are present on RSA, such as Adams Cave, although this is a very small cave. Also, terrestrial community components can be recognized in caves that are better known for their aquatic elements, such as Bobcat and Matthews Caves.

Dominant animal species found in terrestrial caves on the Arsenal include: scorpions (*Tyrannochthonius* spp.), pseudoscorpions (*Kleptochthonius* spp.), spiders (*Nesticus* spp., *Centromerus latidens*, *Eidmanella pallida*), mites (*Cambala minor*), millipedes (*Pseudotremia* spp., *Trichopetalum* spp.), crickets (*Ceuthophilus gracilipes*, *Euhadenoecus* spp.), slimy salamander (*Plethodon glutinosus*), and zigzag salamander (*Plethodon dorsalis*). Rare animals consist primarily of troglobitic invertebrates.

Springs

Springs develop at points where the groundwater table intersects the land surface and water is issued from the substrate. The spring may be subdivided into a spring pool at the head of the spring, and a spring run, the channel that delivers the waters to the receiving stream.

Williams Spring is the most noticeable spring on the Arsenal and has a discharge rate of approximately 3,800 liters per minute. A second discrete unnamed spring, is located on McDonald Creek at Hansen Road. This spring is smaller and has a lower discharge rate than Williams Spring. Numerous small springs are present throughout the Arsenal that feed Indian Creek, McDonald Creek, and Huntsville Spring Branch, but these springs are often within the stream channel, or if above the stream channel are of such small size as to be easily overlooked.

Characteristic plant species associated with these springs are: box elder (*Acer negundo*), sugar maple (*Acer saccharum*), river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), trumpet vine (*Campsis radicans*), *Smilax* spp., Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Rhus radicans*), and pawpaw (*Asimina triloba*).

Dominant animal species associated with Arsenal springs are: southern two-lined salamander (*Eurycea cirrigera*), centrarchids, and *Elimia* spp. Only one rare animal, Tuscumbia darter (*Etheostoma tuscumbia*), utilizes springs.

3.3 CULTURAL RESOURCES

Cultural resources consist of prehistoric and historic districts, sites, structures, artifacts, and any other physical evidence of human activity considered important to a culture or community for scientific, traditional, religious, or other reasons. Cultural resources are divided into three categories: archaeological (prehistoric and historic), historic resources and structures, and traditional (e.g., American Indians, Hawaiian, or other ethnic groups).

Prehistoric archaeological resources are defined as physical remnants of human activity that predate the advent of written records in a particular culture and geographic region. They include archaeological sites, structures, artifacts, and other evidence of prehistoric behavior.

Historic resources consist of physical properties or locations postdating the advent of written records in a particular culture and geographic region. They include archaeological sites, structures, artifacts, documents, and other evidence of human behavior. Historic resources also include locations associated with events that have made a significant contribution to history or that are associated with the lives of historically significant persons.

Traditional native resources may be prehistoric sites and artifacts, historic areas of occupation and events, historic and contemporary sacred areas, materials used to produce implements and sacred objects, hunting and gathering areas, and other botanical, biological, and geological resources of importance to contemporary American Indian groups.

The earliest recorded archaeological work on what is now RSA was performed in 1915. More extensive and exacting regional excavations took place in the 1930s. Federal compliance studies have been done at the Arsenal since the 1970s, although the exact number of acres requiring surveys is unknown. Phase I surveys continue to be conducted on RSA to achieve basic archaeological information. Over 600 prehistoric and historic sites have been recorded on the Arsenal to date. An inventory of historical buildings and structures, fully coordinated with the State Historic Preservation Office (SHPO), has also been conducted for the Arsenal. Currently, there are 440 buildings and structures on RSA and 319 archeological sites that have been formally determined eligible for listing or are listed on the National Register of Historic Places. (AMCOM, 2002a)

The Arsenal is divided into three topographic or land form zones that possess varying degrees of archaeological potential. Zone 1 is composed of rolling land combined with flat plateaus that have undergone considerable erosion and is considered to have low to moderate archaeological potential. Zone 2 is made up of the flood plains on the Arsenal and is considered to have high archaeological potential. Zone 3 is composed of mountainous land and is considered to have low archaeological potential. (U.S. Army Missile Command, 1994)

There are 45 confirmed cemeteries and 20 additional unconfirmed cemeteries shown in historical records located on the Arsenal. These cemeteries are inspected quarterly by government personnel to ensure they are clean and attractive, cleared of weeds and brush, that fences are maintained and closed, and that they are not being plowed or disturbed in any manner. Government contractors and agricultural lessees perform the annual maintenance. (U.S. Army Missile Command, 1994)

3.4 HAZARDOUS MATERIALS AND WASTE

Hazardous Materials

A variety of regulatory agencies define hazardous materials for specific situations. The broadest and most applicable is the Department of Transportation (DOT) definition for transportation of these materials. DOT defines a hazardous material as a substance or material that is capable of posing an unreasonable risk to health, safety, or property when transported in commerce (49 CFR 171.8).

Several federal agencies oversee various aspects of hazardous material usage. DOT regulates packaging and transporting of hazardous materials, under 49 CFR parts 171 through 180 and Part 397. The Occupational Safety and Health Administration (OSHA) regulates the use of hazardous materials in the workplace in 29 CFR, primarily Part 1910. Environmental safety and public health issues associated with hazardous materials are regulated by EPA.

Electrical transformers are the primary source of polychlorinated biphenyls (PCBs) on the Arsenal. If a transformer malfunctions or a leak is detected, it is taken out of service and tested for PCBs before disposal. (U.S. Army Missile Command, 1994)

Hazardous Waste

Waste materials, defined in 40 CFR 261.2, include materials that are both solid and liquid (but contained). Hazardous waste is further defined in 40 CFR 261.3 as any solid waste not specifically excluded which meets specific concentrations or has certain toxicity, ignitability, corrosivity, or reactivity characteristics.

Hazardous waste oversight is provided primarily by the EPA (under the Resource Conservation and Recovery Act [RCRA], the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA], and the Superfund Amendments and Reauthorization Act [SARA]). EPA regulations are found in 40 CFR. DOT regulates transportation of hazardous waste under 49 CFR. Redstone Arsenal Regulation 200-6, *Redstone Arsenal Hazardous Material/Waste Management Program: Hazardous Material/Waste Management Plan* and the Arsenal's RCRA Part B Permit govern Arsenal hazardous and toxic waste operations.

Materials used on the Arsenal include paints, solvents, and cleaning fluids, which are classified by EPA as Hazardous or Toxic Materials. Excess materials are sent to the Defense Reutilization and Marketing Office for re-use, recycling or disposal. Waste

slated for disposal is stored in modified, watertight igloos. (U.S. Army Missile Command, 1994)

3.5 HEALTH AND SAFETY

Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect one or more of the following.

- The well-being, safety, or health of workers - Workers are considered to be persons directly involved with the operation producing the effect or who are physically present at the operational site.
- The well-being, safety, or health of members of the public - Members of the public are considered to be persons not physically present at the location of the operation, including workers at nearby locations who are not involved in the operation and the off-installation population.

The standards applicable to the evaluation of health and safety effects differ for workers and the public; thus, it is useful to consider each separately.

OSHA is responsible for protecting worker health and safety in non-military workplaces. OSHA regulations are found in 29 CFR. For Army operations, AR 385-100, *Safety*, establishes the basis for worker safety programs.

Protection of public health and safety is an EPA responsibility (mandated through a variety of laws - e.g., RCRA, CERCLA/SARA, and the CAA). EPA regulations are found in 40 CFR. Additional safety responsibilities are placed on DOT (for transportation issues [49 CFR]), DOD, and the Department of the Army (program requirements established in AMC 385-100).

FIRE SAFETY

Arsenal lands and inhabited domains are protected from fire hazards to life and property by RSA and local area Huntsville and Madison fire departments. There are four fire departments on the Arsenal covering the Arsenal and the Marshall Space Flight Center. A mutual aid agreement exists among the City of Huntsville, Madison County, the City of Madison, and the Arsenal to assist each other in the event of a major fire. (U.S. Army Missile Command, 1994)

Firebreaks are constructed to impede the progress of fires and to use as trails to transport fire fighting equipment to otherwise inaccessible areas. All wooded areas on the Arsenal are periodically inspected by the Fire Chief to ensure that fire breaks have been properly constructed and maintained.

EMERGENCY SERVICES

The Huntsville/Madison County area offers "911" emergency service to all its residents. The fire and police departments of both counties are connected to this central service. Huntsville Emergency Medical Services, Inc., provides ambulance services for the

Huntsville/Madison County area and, under subcontract, to Redstone Arsenal. Fox Army Hospital, located on the Arsenal, provides medical treatment for military personnel both active and retired and to DOD civilian employees in the area. (U.S. Army Missile Command, 1994)

3.6 INFRASTRUCTURE AND TRANSPORTATION

Infrastructure addresses facilities and systems providing power, water, wastewater treatment, and collection and disposal of solid waste. Transportation addresses the modes of transportation (road, air, rail, marine) that provide circulation within and access to the installation. For this EA, only surface road access will be discussed under transportation, since there are no predominant rail or marine facilities on the Arsenal and the airport is not used as a transportation center.

POWER

The TVA supplies electrical service to RSA. A 155 Megavolts absolute (MVA) electrical supply is available to the Arsenal. The average daily electrical use is approximately 55 to 60 MVA with a peak demand of approximately 80 MVA. There are three primary electrical substations on the Arsenal. (U.S. Army Missile Command, 1994)

Natural gas is provided by North Alabama Gas and obtained through Huntsville Utilities. Natural gas is used for heating in family housing and is the primary fuel for boilers and heating plants on the Arsenal. (U.S. Army Missile Command, 1994)

No. 2 fuel oil is used in the small boilers and heating plants in isolated areas of the Arsenal. This fuel is stored approximately 30 above ground storage tanks on the Installation. The Arsenal also uses steam for heating and other activities throughout the Arsenal. The primary source of steam is the Waste-to-Energy plant owned and operated by the Huntsville Solid Waste Disposal Authority. (U.S. Army Missile Command, 1994)

WATER

Redstone Arsenal obtains the majority of its water supply from the Tennessee River. Potable water is supplied from two, permitted water treatment plants located on the Arsenal (Water Treatment Plants No. 1 and No. 3). Plant No. 1 is the primary industrial water source and obtains raw water from the Tennessee River. Plant No. 3 produces potable water from industrial water. Plant No. 2 is an auxiliary industrial water supply source and is generally inactive, unless the pumps at Plant No. 1 are down for repairs or emergencies. (U.S. Army Missile Command, 1994)

Nonpotable wells, at the Visitors Control Building (5105) and Test Area 3, are used for rest rooms, maintenance, floor washdowns, and livestock watering. Bottled, potable water is also supplied at these sites. (U.S. Army Missile Command 1994)

WASTEWATER TREATMENT

Redstone Arsenal has three connected wastewater systems, with three primary pumping stations. These stations pump raw sewage to a permitted, centralized wastewater treatment plant on the Arsenal. (U.S. Army Missile Command, 1994)

Overall wastewater and solid waste discharges are regulated under the Arsenal's National Pollution Discharge Elimination System Permit Number AL0000019, which specifies discharge limitations and monitoring requirements for wastewater outfall points on the Arsenal. (U.S. Army Missile Command, 1994)

Wastewater on the Installation is collected by 52 miles of sewer lines. All sewers 8 inches or larger were upgraded in 1988. A study is in progress to investigate the infiltration/inflow of water into manholes and sewers in the Wastewater Pumping Station No. 4 area. (U.S. Army Missile Command, 1994)

Storm water drainage is conveyed to the Tennessee River via McDonald Creek, Huntsville Spring Branch, and Indian Creek. The southern portion of the Arsenal drains directly into the Tennessee River. (U.S. Army Missile Command, 1994)

SOLID WASTE

The Arsenal operates a 70-acre permitted landfill to dispose of inert material consisting of rocks, concrete construction materials, asphalt, and construction debris including tree stumps and asbestos. The Arsenal's Solid Waste Disposal Facility (SWDF) permit, issued by the Alabama Department of Environment Management (ADEM), for its construction/demolition landfill allows the disposal of up to 600 cubic yards per day of inert materials such as construction and demolition debris, stumps, limbs, concrete, asphalt, asbestos, and similar type waste or material collected from RSA. At the current rate of use, the site's capacity would be sufficient for another 15 to 20 years (U.S. Army Missile Command, 1994).

Trash and garbage are hauled off-post and disposed of by numerous contractors. The majority of the waste is taken to the Huntsville Solid Waste Authority Waste-to-Energy Plant adjacent to the Arsenal. (U.S. Army Missile Command, 1994)

TRANSPORTATION

The Arsenal has a well-developed roadway network, allowing easy access in three directions (the Tennessee River forms the southern Arsenal border and prevents roadway access in that direction). The major links in the network carry traffic to and from the Arsenal and serve as major arterials for traffic movement within the Arsenal. The major north-south roads on the Arsenal are Rideout, Patton, and Toftoy. The major east-west roads are Goss, Martin, and Redstone. These major roads have paved, all-weather surfaces and are in good condition.

3.7 LAND USE

A Real Property Master Plan, Land Use Analysis for Redstone Arsenal was prepared for the Arsenal's Directorate of Environmental Management and Planning (now the Directorate of Environmental Management) in April of 1999. This plan assists in planning for future growth and development, and promotes compatible and coordinated uses of land. The land on the Arsenal is divided into fourteen major use areas: family housing, troop housing, community facilities, recreation, administration, training facilities, operational facilities, operational maintenance facilities, production facilities, research and development facilities, test areas, storage, post maintenance and utilities, and NASA, Marshall Space Flight Center. (AMCOM, 1999)

The land areas on the Arsenal are classified as improved grounds (3,605 acres), semi-improved grounds (8,953 acres), and unimproved grounds (25,915 acres). Improved grounds include lawns, athletic fields, the golf course, parade and drill grounds, cemeteries, and airfields. Semi-improved grounds include ammunition storage areas, test areas and ranges, firebreaks, picnic areas, wildlife food plots, and utility rights-of-way. Unimproved grounds include agricultural leases, ponds and streams, pavements, roads, railroads, reservoirs, test stands, and woodlands. Land on the Arsenal is owned by the U.S. Army (30,920 acres), WNWR (4,085 acres), and TVA (2,905 acres). (AMCOM, 1999)

The agricultural leasing and grazing program has been ongoing on the Arsenal since shortly after World War II. Currently, there are 3,769 acres of available agricultural land leased to private individuals for production of hay crops and pasture (cattle grazing). Overgrazing of lands by livestock is not evident in the leased areas. The estimated usage for grazing activities in 2001 was 1,885 head of cattle. Revenue from grazing activities is discussed in the Socioeconomics section of this EA. Proper coordination between the military and the lessees has served to keep idle lands to a minimum. Arsenal regulations prohibit livestock on the roads, training areas, test ranges, airfield runways, and other areas where livestock pose a safety hazard. (U.S. Army Missile Command, 1994)

According to the Redstone Arsenal forest inventory, 15,656 acres are covered in forest. This figure is broken down into approximately 4,627 acres as pines; 8,531 acres as hardwoods; 1,994 acres as mixed pine-hardwoods; and 504 acres as mixed cedar-hardwoods.

Forested land consisting of hardwoods, pines, and mixtures of the types are distributed across 41 percent of the 37,910 acre landscape. Elevations range from 556 to 1,239 feet.

Limited logging operations occurred prior to 1953. The first major logging activities were carried out in 1953 and 1954 for range clearing requirements. Professionally planned timber harvesting by annual government sales began in 1958. The first forest management plan was implemented in 1970 and prescribed forest management activities to ensure optimum resource management. (U.S. Army Missile Command, 1994)

There are 45 confirmed cemeteries (plus 20 cemeteries shown in historical records, but unconfirmed) located on RSA. These cemeteries are inspected quarterly by government personnel to ensure they are clean and attractive, cleared of weeds and brush, that fences are maintained and closed, and that they are not being plowed or disturbed in any manner. Government contractors and agricultural lessees perform the annual maintenance. (U.S. Army Missile Command, 1994)

There are no off-road vehicle areas on the Arsenal. It has been determined that there is no suitable area on the Arsenal for such use (U.S. Army Missile Command, 1994).

3.8 NOISE

Noise is unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment; it may be intermittent or continuous, steady or impulsive. Noise may also involve a broad range of sound sources and frequencies and be generally nondescript, or it can have a specific, readily identifiable sound source. The decibel (dB) is the accepted standard unit for measuring the level of noise and is generally adjusted to the “A-weighted” logarithmic scale (dBA) to better correspond to the normal human response to different frequencies. Several metrics have been developed for multiple-noise event analysis. The one most commonly used is the Ldn (calculated noise level) metric. This is the dBA level averaged over a 24-hour period, with an additional ten dBA penalty added for noise events occurring between 10 p.m. and 7 a.m. (because noise at night is judged to be more annoying than noise during the day). The threshold noise level for compatible land uses is Ldn 65 dBA. Areas outside (less than) of the 65 dBA Ldn contour are compatible with residential and other noise-sensitive land uses.

Redstone Arsenal has developed an Installation Compatible Use Zone Program to identify noise-generating areas on the Arsenal and to minimize encroachment of noise sensitive activities both on and off the Arsenal. It is not intended to inhibit operations but to inform community officials of the expected noise generation from mission-related activities. Army facility planners work with the community governments and planning agencies to promote adequate buffer zones between the Installation’s noise sources and the noise-sensitive areas. (U.S. Army Missile Command, 1994)

Within the Arsenal the principal sources of noise are rocket motor flight test and static firings, warhead detonations/impacts, gun firings, demolitions, and airfield operations. Noise producing activities on the Arsenal are located such that a significant buffer zone exists between noise producing activities and the nearest population centers. The largest population densities adjacent to the Arsenal are in Huntsville on the north and east boundaries. (U.S. Army Missile Command, 1994)

The City of Huntsville has adopted Noise Ordinance 88-663 that regulates noise production by various sources and defines levels of ambient noise for several types of land use. City ordinances cannot be enforced outside of city limits; therefore, the city noise ordinance does not apply to Redstone Arsenal. (U.S. Army Missile Command, 1994)

The primary sources of noise associated with implementing the INRMP would be from timber harvesting activities or equipment used in preparing food plots, hay crop production, or normal agriculture leased land maintenance activities.

3.9 GEOLOGY AND SOILS

In general the Arsenal's topography is gently rolling with elevations primarily in the range of 600 to 650 feet MSL. The terrain generally slopes southward towards the Tennessee River. High areas on the Arsenal include Weeden and Madkin Mountains in the north-central portion of the Arsenal, with elevations up to approximately 1,200 feet above MSL. Bluffs such as Lehman's and Bell's along the Tennessee River are listed as outstanding natural areas (Alabama Natural Heritage Program, 1995). Low areas, comprised of valleys and floodplains along the Tennessee River and its tributaries to the north, are characterized by elevations of approximately 560 feet above MSL. (U.S. Army Missile Command, 1994)

GEOLOGY

The rocks of Madison County are sedimentary in origin. They consist predominately of several varieties of limestone, sandstone, and a few acid shales. The rocks are currently in a relative horizontal position. Rock formations will be discussed from the oldest to the youngest, and will only be concerned with the units that can be seen in outcrop in the county.

The Chickamauga limestone formation is of Ordovician age. This formation is characterized by thinly bedded, cobbly, and highly fossiliferous clay lenses that can be found in this formation. Overlying the Chickamauga limestone is Fort Payne chert. The Fort Payne chert is characterized by coarsely crystalline thick bedded limestone and beds of dark siliceous shale that weather and leave black flint and chert. The cherty residuum can be from 400 to 500 feet thick in places. The Tuscumbia limestone overlies the Fort Payne chert. The Tuscumbia limestone is the surface formation for more than half of Madison County including the Arsenal area. Tuscumbia limestone is the surface rock extending from the eastern edge of the mountain area to the west to the northwestern quarter where the Fort Payne chert predominates. The Gasper formation overlies the Tuscumbia formation. It is the surface rock in the southern parts of the Flint and Paint Rock River Valleys and along the base of the mountains. Much of the rock is covered by alluvium and valley fill. The Pottsville formation is the highest lying formation and geologically the youngest. It is characterized in the upper portion as a hard massive sandstone that is the parent material of the Hartsells, Linker, and Muskingum soils. This upper portion is approximately 200 feet thick. The lower portion is comprised of a bed of shale 30 feet thick. (Soil Conservation Service, 1980).

SOILS

According to the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Madison County, a total of 94 soil phases representing 39 different soil series are mapped within RSA grounds (Soil Conservation Service 1980). The

predominant soil type mapped for the Arsenal consists of a deep, well-drained to moderately well-drained, silt loam to silty clay loam. These soils typically possess a loamy surface horizon underlain by a loamy to clayey subsoil layer with lenses of silty and/or sandy clay. Rock fragments generally occur throughout the clayey material. The soil colors range from a brownish-red in the northern portion to a brownish-gray in the southern portion of the Arsenal. Darker gray soils are found in areas of topographic lows. Soil depths range from very shallow on the mountains to much deeper along the larger tributaries of the Tennessee River where broad flood plain areas have been formed by the river and its tributaries. No significant mineral deposits are known to exist on Redstone Arsenal (U.S. Army Missile Command, 1994).

Of the 94 soil phases mapped for the Arsenal, 52 of these phases representing 2 soil series are listed as potential prime farmland by the USDA SCS (Soil Conservation Service, 1980). These prime farmland soils are located throughout a large portion of the level to gently sloping areas of the Arsenal, including uplands, foot slopes, stream terraces, and floodplains. Within areas of the Arsenal that are mapped as prime farmland, contiguous units of ten acres or more of urban or built up land are excluded. Additionally, areas mapped as Egam silty clay loam or Ennis silt loams are also excluded as prime farmlands, where flooding during the growing season is more than once in two years. However, the SCS has determined that the prime farmland areas at the installation are excluded from consideration as prime farmland per the Farmland Protection Policy Act. Federal and urban lands are excluded from consideration as prime farmlands per Farmland Protection Policy Act PL 97-98. This determination was made in accordance with guidelines provided in the national Agricultural Land Evaluation and Site Assessment handbook, Section 601.04 (d), Lands to be Considered (U.S. Army Missile Command, 1994).

3.10 SOCIOECONOMICS

Socioeconomics within this EA is concerned with population, employment, and recreation for the area as well as the economic impacts to the Arsenal from grazing, timber cutting, and associated agricultural lease activities.

Although at one time a rural town, Huntsville has emerged as a center for military and space technology with the center of activity in the region located at Redstone Arsenal. This has occurred with the consolidation of Research and Development activities for U.S. Army rocket and missile projects at the Arsenal that continues to contribute to the region's economy. The Arsenal's presence has led to the convergence of a large number of defense contractors in the Madison County area. (U.S. Army Missile Command, 1994)

Redstone Arsenal, as a major employer in Madison County, impacts the local economy through direct employment of civilian and military personnel as well as through the local procurement of goods and services. Direct employment by the Arsenal as well as employment directly generated from the Arsenal's procurement expenditures have led to an increase in the level of economic activity and the creation of additional employment opportunities. (U.S. Army Missile Command, 1994).

The State of Alabama, Madison County, and the local Huntsville area offer an extensive selection of recreational activities. Redstone Arsenal also offers an extensive recreational program with numerous facilities and a diversity of activities. There are various outdoor recreational activities offered that utilize the Arsenal's lands. These include golf, fishing, swimming pools, and playing fields concentrated in the northern portion of the Arsenal convenient to family and troop housing areas. Two recreational areas are located along the Tennessee River. Facilities at these locations include playing fields, picnic areas, boat ramps, fishing piers, and a campground. Hunting, fishing, and trapping licenses are sold for these activities on the Arsenal. (U.S. Army Missile Command, 1994)

There are direct benefits from the agricultural and grazing programs in place on the Arsenal. These benefits come in the form of cash rental paid to the government from the lessees. In 2000 the income generated through these leases was approximately \$48,000. There are additional services that provide indirect value to the government. The estimated value of these services is the total value of all work that the lessees do on the land for which the government does not have to pay. These services are in the form of mowing, seeding of eroded areas, clearing, seeding of pastures, maintenance of drainage ways, fertilization, weed control, and fence construction. The estimated value of these services is approximately \$244,985 per annum on over 3,769 acres of agricultural leased land.

Timber sale planning is determined from the latest inventory data supported by ground reconnaissance, timber type and quality, cultural resources, threatened and endangered species, soils suitability, terrain, soil contamination and hazardous materials, potential Army mission conflicts, training schedules, and time available for timber removal. Although the management objective is generally a selective tree removal operation with least disturbance to the residual environment, the predominant factor that influences the opportunity of a harvest sale is the optimum volume per sale with given environmental factors. The applicable rule of thumb is no less than 1,500 board feet or 5 cords per acre or a combination that would provide an equivalent volume of wood on no less than 80 acres. (U.S. Army Missile Command, 1994)

Hunting and fishing permits are required when engaging in these activities on the Arsenal. Income from these permits is used to manage fish and wildlife resources on the Arsenal.

Non-consumptive recreational opportunities (e.g. bird and wildlife watching) are abundant on the Arsenal. For example, construction was completed in 1995 of a Watchable Wildlife Site in Wetlands with Interpretive Trail on Redstone Arsenal. The site includes a 30' by 50' covered outdoor classroom; a 150' boardwalk through a tupelo swamp; a 350' boardwalk through a scrub/shrub swamp; and a 3,800' ecological interpretive trail with educational signage on wetlands concepts, vegetation and wildlife.

3.11 WATER RESOURCES

Water resources include both surface water and groundwater. To protect these resources, and human health, Congress has enacted the Clean Water Act and the Safe Drinking Water Act. The EPA has also established water quality standards to protect water resources.

SURFACE WATER

The Tennessee River forms the southern boundary of the Arsenal. Major watercourses that flow through the Arsenal include Indian Creek, Huntsville Spring Branch, and McDonald Creek. Each of these tributaries flows generally south and then west toward the city of Triana to empty into the Tennessee River. (U.S. Army Missile Command, 1994).

The majority of the western portion of the Arsenal is drained by Indian Creek and the eastern half of the Arsenal is drained by Huntsville Spring Branch. Indian Creek originates north of the Arsenal in northwestern Madison County and flows southward across the Arsenal to Wheeler Reservoir. Indian Creek drains approximate 63 square miles of area (U.S. Army Missile Command, 1994). Indian Creek has been classified for fish and wildlife use by ADEM. This wildlife and fish classification was based upon the presence of wastes, pH, temperature, dissolved oxygen, toxic or other deleterious substances (U.S. Army Missile Command, 1994). McDonald Creek runs along the eastern edge of the Arsenal and drains approximately 14 square miles of the northeastern corner of the Arsenal. Huntsville Spring Branch originates from a spring in the City of Huntsville. Huntsville Spring Branch flows southeasterly across the Arsenal and drains approximately 83 square miles of area (U.S. Army Missile Command, 1994), emptying into Wheeler Lake. Huntsville Spring Branch is also classified by ADEM as a fish and wildlife use area.

Approximately one-third of the Arsenal lies within the 100-year floodplain of the Tennessee River (U.S. Army Missile Command, 1994). The 100-year floodplain lies at elevations ranging from 570 to 575 feet above MSL. For planning purposes, the 100-year flood level for the Arsenal has been determined to be 572.5 feet above MSL.

The main source for industrial water for the Arsenal is the Tennessee River's Wheeler Reservoir. Wheeler Dam, located approximately 45 miles west of and downstream of the Arsenal, maintains a full pool elevation of about 556 MSL. (U.S. Army Missile Command, 1994)

GROUNDWATER

The quality of the surface water varies across the drainage divide of the Arsenal. In the western half of the drainage area (including Indian Creek, western portions of the Tennessee River, and Wheeler Reservoir) the surface water is characterized as "moderately hard" to "hard," moderately high in dissolved solids, locally high in manganese, and suitable for most uses after treatment. In the eastern portion of the

drainage divide (including Huntsville Spring Branch, McDonald Creek, and the eastern portion of Wheeler Reservoir) the water is characterized as “hard” to “very hard,” locally acidic, low in dissolved oxygen, locally high in manganese, and high in biochemical oxygen demand. (U.S. Army Missile Command, 1994)

The hydrogeology at the Arsenal can be characterized by three units: the regolith, the Tuscumbia/Fort Payne formation, and the Chattanooga shale. The Fort Payne chert and the Tuscumbia limestone comprise the limestone aquifer. This aquifer is characterized by abundant groundwater supplies suitable for potable and industrial uses. The upper regolith and the Chattanooga shale act as confining beds for the upper and lower boundaries of the limestone aquifer respectively. Due to this confining action of the regolith and Chattanooga shale, the limestone aquifer is under artesian conditions in many areas. Groundwater movement reflects the surface topography and is generally flowing from the north to the south towards the Tennessee River. The potentiometric surface beneath the Arsenal ranges from 560 feet above MSL to greater than 600 feet above MSL. The aquifers beneath the Arsenal are some of the most productive in Madison County. None of the aquifers in Madison County have been designated as sole source aquifers per Section 1424(2)g of the Safe Drinking Water Act of 1974 (U.S. Army Missile Command, 1994).

Groundwater from shallow wells drilled into the Tuscumbia limestone generally produces good quality water that is moderate in dissolved minerals. The average pH for groundwater in Madison County is 7.5. Due to past disposal and operations at the Arsenal several areas of contaminated groundwater currently exist at the Arsenal. Several different potential contaminants are present in the groundwater in varying concentrations including arsenic, trichloroethylene (TCE), benzene, and dichlorodiphenyltrichloroethane (DDT). (U.S. Army Missile Command, 1994) The former Thiokol plant on the eastern part of Redstone had a TCE spill in 1989. At that time, Thiokol operated a facility that manufactured rocket motor propellant using TCE in its degreaser. In 1994, Redstone officials began planning an interim fix to treat groundwater that contained residues of this solvent. The pump-and-treat facility went on line in early 1997, demonstrated good results and entered full operation in early April. However, groundwater contaminated with solvents and perchlorate has migrated from RSA to off-post residential communities located along the eastern boundary. Off-post contamination in springs, ponds, and a creek are currently below levels of health concern. In addition, remedial investigations by the Army are proceeding at 73 sites and pump and treat systems are operating to control the movement of contaminated groundwater. (U.S. EPA, 2002)

CHAPTER 4.0 ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental consequences of managing natural resources at RSA under an INRMP. The conditions are described for the five year period of Fiscal Years (FY) 2002 through 2007, as anticipated under the No Action Alternative and the Preferred Alternative. Impacts are described quantitatively where possible and qualitatively where data are not available. Impacts range from no significant impact to beneficial impact. The impact evaluations are presented at the programmatic level and consider the impacts that would occur from implementing the individual actions that make up an alternative. General mitigation measures relevant to the resource categories are presented.

Impacts were determined by comparing proposed project activities with the potentially affected environmental components. Sections 4.1 through 4.11 evaluate the potential environmental consequences of the proposed activity. The amount of detail presented in each section is proportional to the potential for impacts. Sections 4.12 through 4.23 discuss the following with regard to proposed project actions: cumulative impacts summary; mitigation measures summary; individuals/organizations responsible for obtaining required permits/licenses/entitlements; conflicts with federal land use plans, policies, and controls; energy requirements and conservation potential; natural or depletable resource requirements and conservation potential; irreversible or irretrievable commitment of resources; biological diversity; adverse environmental effects that cannot be avoided; the relationship between the short-term uses of the human environment and the maintenance and enhancement of long-term productivity; federal actions to address environmental justice in minority populations and low-income populations; and conditions normally requiring an environmental impact statement.

Federal environmental laws and regulations were reviewed to assist in determining established thresholds for assessing environmental impacts (if any) in fulfillment of NEPA requirements. Proposed activities were evaluated to determine their potential to result in significant environmental consequences using an approach based on the interpretation of significance outlined in the CEQ regulations for implementing the procedural provisions of the NEPA (40 CFR 1500-1508) and 32 CFR Part 651 (U.S. Department of the Army, 2002).

Guidelines established by the CEQ (40 CFR 1508.27) specify that significance be determined in relationship to both context and intensity (severity). Significance can vary in relation to the context of the Proposed Action. Context may include considering the effects on a national, regional, or local basis. Both short- and long-term effects may be relevant. Three levels of impact can be identified:

- No Impact - No impact is predicted.
- No Significant Impact - An impact is predicted, but the impact does not meet the intensity/context significance criteria for the specific resource.
- Significant Impact - An impact is predicted that meets the intensity/context significance criteria for the specific resource.

Factors contributing to the intensity or severity of the impact include the following:

- The degree to which the action affects public health or safety;
- Unique characteristics of the geographic area such as proximity to cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas;
- The degree to which effects of the action on the quality of the human environment are likely to be highly uncertain or controversial;
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration
- Whether the action is related to other actions with individually insignificant, but cumulatively significant, impacts;
- The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the NRHP or may cause loss or destruction of significant scientific or cultural resources;
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the ESA; and
- Whether the action threatens to violate a federal, state, or local law or requirements imposed for environmental protection.

Thresholds for determining impact significance are based on the applicable compliance standard. When feasible, these criteria correspond to federal- or state-recognized criteria, and are determined using the associated standardized methods. In the absence of compliance standards, the thresholds are based upon a federal- or state-recommended guidance or follow professional standards/best professional judgment. The criteria and the significance thresholds used for comparing the alternatives for Redstone Arsenal are shown in Table 4-1. The criteria or the associated thresholds are tailored to the environmental conditions at Redstone Arsenal.

Table 4-1 Criteria, Thresholds, and Methods for Impact Assessment

Subject Area/ Resource Category	Criteria	Threshold	Method
Air Quality	Air quality exceedance	Emits pollutants above air emission limits established in Redstone Arsenal's permit; contributes substantially to an existing or projected air quality violation; or exposes sensitive receptors to substantial pollutant concentrations	EPA or State of Alabama appropriate methods
Biological Resources <ul style="list-style-type: none"> Flora and Fauna Threatened and Endangered Species 	<p>Ecosystem integrity</p> <p>Federal- and state-listed threatened or endangered species or species proposed for federal or state listing as threatened or endangered; nesting birds protected by the Migratory Bird Treaty Act</p>	<p>Causes alternation of more than 10% of a "natural community" to a nonnatural status; reduces a wildlife population to below self-sustaining levels; or introduces or increases prevalence of noxious weeds or new exotic species.</p> <p>Causes mortality, critical habitat loss, or lowered reproductive success (Endangered Species Act) or causes direct impacts or disturbance to nesting birds protected by the Migratory Bird Treaty Act</p>	<p>Professional standards/best professional judgment; biological monitoring</p> <p>Professional standards/best professional judgment (survey); record taking</p>
Cultural Resources	Sites, structures, or objects listed or eligible for listing in the NRHP or National Landmarks	Effect or adverse effect as defined by the National Historic Preservation Act (1966, as amended)	Professional standards/best professional judgment

Subject Area/ Resource Category	Criteria	Threshold	Method
Geology and Soils	Soil loss due to erosion	Does not affect prime farmland	Revised Universal Soil Loss Equation (Renard et al.1997); professional standards/best professional judgment
Hazardous Materials and Waste	Compliance with regulatory guidelines	Hazardous materials or waste not handled/disposed appropriately	DOT, EPA, and OSHA regulations
Health and Safety	Compliance with OSHA, EPA, and DOT regulations	Activities that affect the well-being, safety, or health or workers or members of the public	29 CFR (OSHA), 40 CFR (EPA), 49 CFR (DOT) and AR 385-100
Infrastructure and Transportation	Infrastructure or transportation change	Results in a substantial alteration of the present infrastructure or transportation routes on Redstone Arsenal	Professional standards/best professional judgment
Land Use	Land use change	Results in a substantial alteration of the present or planned land use of Redstone Arsenal or increases visual contrast beyond the visual resource measure class objective for the location	Professional standards/best professional judgment; visual quality analysis ¹
Noise	Noise-generating activities	65 dBA for compatible land uses; less than 65 dBA Ldn for residential and other noise-sensitive land uses	AMCOM ICUZ Program; City of Huntsville Noise Ordinance 88-663

Subject Area/ Resource Category	Criteria	Threshold	Method
Socioeconomics	Population growth, income levels, unemployment, and environmental justice	Causes more than 10% change in population levels over historic baseline; increase unemployment by more than local projections; causes per capita income to drop below poverty level; or causes adverse environmental, economic, social, or health impacts to be disproportionately placed on minority or low-income populations (E.O. 12898)	Socioeconomic analysis and human health and environmental analysis.
Water Resources <ul style="list-style-type: none"> • Surface and Groundwater • Wetlands 	<p>Water quality</p> <p>Violates Clean Water Act Section 404 or Rivers and Harbors Act of 1899; or violates permit conditions or mitigation requirements for previously authorized activities</p>	<p>Exceeds or violates Alabama water quality standards or objectives, including National Pollutant Discharge Elimination System permitted outfalls</p> <p>Unauthorized activities occurring within jurisdictional waters of the United States; failure to meet specific permit conditions or mitigation requirements</p>	<p>EPA or State of Alabama approved methods</p> <p>Best professional judgment or enforcement action by the U.S. Army Corps of Engineers</p>

Note: Non-exceedance of a threshold does not imply an absence of an impact. Non-exceedance of a threshold means that there is no significant impact anticipated from the action.

¹Visual quality analysis for pre-and post-project comparisons using standardized methods such as the U.S. Forest Service visual quality analysis or other appropriate method.

Using the significance criteria identified in Table 4-1, the following alternatives were analyzed: Basic Ecosystem Management (No Action Alternative) and Integrated Ecosystem Management under an INRMP (Preferred Alternative).

4.1 AIR QUALITY

Criteria pollutants are those chemicals for which ambient air quality standards have been promulgated. These criteria pollutants are emitted primarily from combustion sources such as power plants, boilers, aircraft engines, automotive engines, solid waste incinerators, and burn pits. These pollutants are regulated and controlled so that the concentration does not exceed either short-term or long-term standards. Under the CAA, federal actions must not cause or contribute to any new violation of air quality standards, increase the frequency or severity of any existing violation, or delay the timely attainment of any air quality standard or interim milestone.

Non-criteria pollutants are all other air pollutants that are regulated and controlled by emission standards or other health-risk-based criteria. As the various portions mandated by the 1990 CAA Amendments are promulgated by the EPA, the number of regulated pollutants has continued to grow. These pollutants may be emitted from many different sources, such as the use of solvents in paint, automobile maintenance, and metals and organic emissions from solid waste incineration activities.

The following sections describe the impacts to the environment from the Preferred Alternative and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to air quality.

4.1.1 Preferred Alternative

There would be no significant impacts to air quality from actions such as timber harvesting, site preparations/excavations, planting, prescribed burning, hay harvesting and food plots planting from implementing the INRMP. Although small amounts of fugitive dust and combustive emissions would be generated from earthwork type activities, federal and state NAAQS concentrations would not be exceeded. While prescribed burning events on the Arsenal will emit smoke, no significant impacts to air quality are anticipated because only small areas will be burned at any one time.

Prescribed Burning Procedures at RSA are designed to ensure compliance with federal, state, and local requirements by specifying coordination with the AMCOM Public Affairs, Weather Station (to ensure acceptable weather conditions), City of Huntsville Natural Resources Office, Alabama Forestry Commission (to obtain Burn Permit, if required), AMCOM Directorate of Environmental Management, AMCOM Emergency Operations, Redstone Arsenal's Provost Marshal's office, Range Operations Office, area residents, and the AMCOM Fire Department (that grants final approval for burning).

4.1.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented. However, basic ecosystem management would continue. There would be no appreciable impacts to air quality because there would be no change to the general types of activities in the area.

4.1.3 Cumulative Impacts

While the periodic prescribed burning on RSA would emit smoke, cumulative impacts are not expected to air quality because of the small amounts of acreage burned at any one time. There are also no additional past, present, or reasonably foreseeable actions that would create cumulative impacts to air quality.

4.1.4 Mitigation Measures

Since the periodic prescribed burning on the Arsenal will emit smoke, mitigation measures for air quality would include burning small areas at any one time and varying the burn schedule. In addition, following the Prescribed Burning Procedures would ensure compliance with federal, state, and local requirements.

4.2 BIOLOGICAL RESOURCES

Biological diversity (biodiversity), or the variety of life and its processes, is a basic property of nature that provides enormous ecological, economic, and aesthetic benefits. The loss of biodiversity is recognized as a major national as well as global concern with potentially profound ecological and economic consequences. The potential to positively impact biodiversity does exist with certain management components of the INRMP. Ecosystem management focuses on systems rather than on single-species, and manages invasive or exotic species. Other benefits of ecosystem management include monitoring and protecting wetlands, managing vegetation fire hazards, managing wildlife populations, and implementing and enforcing water resources protection regulations. Proper and timely implementation of prescribed burns, selected timber harvest, and placement of food plots can also enhance biodiversity and improve forestry and fish and wildlife resources. All of these measures, in addition to the special protection already afforded wetlands and threatened and endangered species, will enhance these resources as well.

The following sections describe the impacts to the environment from the Preferred Alternative and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to biological resources.

4.2.1 Preferred Alternative

The Preferred Alternative is to implement the INRMP in a timely and effective manner and ensure the wise protection, use, and management of resources within RSA. By using a coherent management system, existing biological resources would be protected from

encroachment by installation activities, and beneficial impacts to biological resources would be anticipated.

VEGETATIVE COMMUNITIES

Implementing the INRMP's Forest Management Plan would improve sustainability of healthy, diverse, and productive forest resources on the Installation and result in overall positive benefits. Additionally, visual resources would benefit from the structured replanting of harvested trees and the continued improvement of timber stands. Commercial forestlands would continue to be properly maintained and logging operations would continue. Varied forest compartments are planned for timber harvesting each year from 2002 through 2007. Adherence to this schedule will be contingent upon applicable forest soils listed in the Soils Suitability Table of the INRMP, cultural resources, threatened/endangered species, and missions requirements for forested areas. An overall three-year schedule has been adopted for the entire forest resource to provide the opportunity to perform other forest improvement activities (i.e., prescribed burning) and provide the latitude to harvest priority stands and stay within the cutting cycle. Harvests will be geared towards thinning many of the overstocked timber stands to promote increased growth and decrease the possible spread of timber diseases. (U.S. Army Missile Command, 1994)

Prescribed burning on RSA is conducted in accordance with AR 200-3, *Natural Resources Land, Forest, and Wildlife Management* and TM 5-631, *Natural Resources Forestry Management*. Prescribed burning of each area would be coordinated, scheduled, and conducted such that the desired use of the land is maximized. Benefits derived from the burning program are removal of undesirable understory vegetation, more acceptable habitat for wildlife species, improved military training areas, reduction of hazardous fuel accumulation, recycling of nutrients within the soil, control of disease and insect pests, improved mobility of wildlife within forest stands, enhanced forest appearance; and preparation of sites for planting.

Currently, approximately 300 acres of land are wildlife food plots. Species planted in these plots include: corn, iron claypeas, soybeans, milo, sunflowers, brown top millet, prozo millet, Egyptian wheat, and bicolor lespedeza. This acreage represents less than 1% of Arsenal land. A goal of wildlife management is to have approximately 10% or some 3,800 acres serving as wildlife food plots. (Nixon, 2002)

FISH AND WILDLIFE COMMUNITIES

Implementing the INRMP's Fish and Wildlife Management Plan would improve the sustainability of healthy, diverse, and productive plant and animal communities reflective of a naturally balanced ecosystem. Harvestable populations of deer, turkey, and gamebirds (primarily dove and quail) and their habitats are maintained and enhanced with prescribed burning, selected tree cuts, and establishment of food plots. Native plant communities as well as nongame species are also encouraged by these actions.

The fisheries management plan presented in the INRMP is inadequate to provide a sustainable fishery in impounded waters identified for sport fishing. These impoundments include Finance Pond and the “Bradford Sinks”. Fishing is no longer allowed in Igloo, Rock Quarry or Rock ponds due to contamination and training activities in the area. (Nixon, 2002).

Some impounded waters are infested with aquatic macrophytes such as water lilies (*Nymphaea* spp.) and American lotus (*Nelumbo lutea*). Buttonbush (*Cephalanthus occidentalis*) is also a problem along shallow pond margins and wetlands. These are tenacious plants that are difficult to control once established. Eradication of water lilies and American lotus may require repeated applications of chemical herbicides (usually 2,4-D) or physical removal for complete control. However, no chemical treatment will be performed due to funding constraints. Herbicides can certainly be used to eliminate buttonbush, but periodic burning is often an effective control measure.

Another factor that impacts impounded waters is sediment deposition in ponds. Deposition of silt and organic matter is a natural process that, over time, can lead to the loss of water bodies. Depending on a variety of factors (*e.g.* watershed type and vegetation, flow rates, etc.) and intended uses, it would be advantageous to periodically dredge ponds to maintain suitable depths. However, due to funding constraints and lack of approved disposal areas dredging is not planned. (Nixon, 2002)

Deficiencies in the fisheries portion of the INRMP Fish and Wildlife Management Plan would need to be addressed if the Army desires sustainable harvests of sport fish from Arsenal impoundments. Baseline data, to include water quality and morphometric measurements for the ponds, should be collected and analyzed. This data is necessary to make management decisions regarding liming and fertilization rates for increased ponds productivity. Information on fish stocks from creel data or electroshocking should also be collected and examined to ascertain the state of balance and condition of the fish. This information is necessary to make management decisions on harvest rates and catch and release policies.

WETLANDS

Implementing the INRMP would improve the sustainability of plant and animal species diversity and numbers on the Arsenal’s approximately 9,889 acres of wetlands. Even though protection of wetlands is a mandated compliance issue, improvements to resources around these areas are beneficial to the overall health and diversity of these systems.

Wetlands are critical to the survival of a wide variety of animals and plants, including numerous threatened and endangered species. For many species such as the wood duck, muskrat and swamp rose, wetlands are primary habitats. For others, wetlands provide important seasonal habitats where food, water and cover are plentiful.

As biologically productive natural ecosystems, the wetlands resources found on Redstone Arsenal are critical to sustaining biodiversity in the defined region of influence and beyond.

AQUATIC RESOURCES

Aquatic habitats and the broad range of species found in the 10,000 acres of the Arsenal affected by the Tennessee River and other tributary systems (U.S. Army Missile Command, 1994) would be managed and improved to further support habitat and species biodiversity in the region of influence and beyond.

THREATENED AND ENDANGERED SPECIES

Implementation of the INRMP would have indirect positive benefits to threatened and endangered floral and faunal species indigenous to RSA and their habitats. Managing forested areas on the Arsenal, as prescribed in the INRMP, is a prime example of an action that indirectly optimizes wildlife habitat for threatened and endangered species as well as other game and non-game species. As with wetlands, threatened and endangered species and their habitats are afforded special protection by mandate under the ESA.

The USFWS will be consulted as necessary to determine impacts to threatened and endangered species, as well as species that have been proposed for listing.

UNIQUE HABITATS

The numerous unique habitats located throughout the Arsenal would also be afforded special protection. Under the INRMP no activities would occur in and around these unique habitats.

4.2.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented. However, basic ecosystem management would continue. Beneficial impacts to biological resources would continue through the management of invasive and/or exotic species; monitoring and protection of wetlands; management of vegetation fire hazards; preservation and maintenance of trees; and the management of wildlife populations.

4.2.3 Cumulative Impacts

Positive cumulative impacts are expected to biological resources and biodiversity. Forested areas would be managed for multiple use. Prescribed burning and selective tree cutting would improve wildlife and bird nesting cover and provide legume seed supplies. Wildlife food plots would increase the populations of game and nongame species. Threatened and endangered species and their habitat would also be enhanced by these measures.

4.2.4 Mitigation Measures

There would be positive impacts to biological resources by implementing the INRMP. Mitigation measures are not necessary as long as the management plans outlined in the INRMP are followed. However, the lack of an adequate fisheries management plan detracts from the overall effectiveness of the INRMP. In addition to the special protection afforded wetlands and threatened and endangered species by mandate, implementation of the INRMP would enhance the health and biodiversity of these and other biological resources for both consumptive and non-consumptive uses.

Future plans and programs for the Installation would be evaluated on a case-by-case basis, using the NEPA process, to judge the impacts of these plans or programs on RSA's natural resources.

4.3 CULTURAL RESOURCES

Cultural and archaeological resources are limited, nonrenewable resources whose potential for scientific research or value as a traditional resource may be easily diminished by actions that significantly impact the integrity of the property. Activities that disturb the ground in which an archaeological site is present can destroy temporally and culturally diagnostic artifacts and features or alter artifact provenance. Such alterations to the integrity of a property preclude possible determination that the site may be likely to yield information important in prehistory or history. Significance of impacts is determined by the intensity and context of the alteration of the distinctive characteristics and integrity of a property.

The following sections describe the impacts to the environment from the Preferred Alternative and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to cultural resources.

4.3.1 Preferred Alternative

Beneficial impacts to cultural resources are anticipated. The Preferred Alternative is to implement the INRMP in a timely, consistent, and effective manner to ensure the wise protection, use, and management of Arsenal resources. By establishing a coherent management system, existing cultural resources would be protected from encroachment by Installation activities. No plowing, disking, or other type of excavation would be performed without prior written approval of the staff archeologist. Coordinated consultation activities with the SHPO would continue.

Proposed INRMP work activities are formally submitted to the Directorate of Public Works (DPW). AMCOM's Project Review Committee, which includes the Deputy Director of DPW, examines these proposed activities along with representatives from the Directorate of Environmental Management (NEPA Coordinator), Master Planning, Engineering Department, Family Housing, the Resource Service Office, and the Operations Division, plus ad hoc representatives as may be warranted. (AMCOM, 2002b)

If the proposed INRMP work activity potentially impacts cultural or natural resources by the planned movement or disturbance of earth, alterations to buildings or structures that might be eligible for the National Register of Historic Places, proximity to potential archeological sites, or other environmental resources, DEM will further evaluate. (AMCOM, 2002b)

4.3.2 No Action Alternative

If the No Action Alternative is chosen, the INRMP would not be implemented, and therefore the Cultural Resources Management Plan would not be integrated into the overall management plan of RSA's natural resources. However, basic ecosystem management would continue. Cultural resources would continue to be managed by a five-year plan of operating policies and procedures that will ensure compliance with applicable federal laws and implementing regulations as defined in the *Integrated Cultural Resources Management Plan*, May 2002. Therefore, beneficial impacts to cultural resources would continue because there would be no change to the general types of activities in the area.

4.3.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact cultural resources in a cumulative manner; therefore, no cumulative impacts are expected.

4.3.4 Mitigation Measures

Proposed INRMP work activities sent to DPW that involve the movement or disturbance of earth, alterations to buildings or structures that might be eligible for the NRHP, impact to potential archeological sites, or other environmental impacts are examined by the Project Review Committee, which includes the Arsenal's NEPA Coordinator and a Master Planning Division representative. The staff archeologist conducts a reconnaissance survey to determine if any cultural resources will be impacted by the proposed work and recommends modifications or initiation of action such as a Phase II Archeological Survey, if necessary. All Phase II Archeological Surveys are coordinated with the SHPO for concurrence prior to beginning the survey and prior to any earthwork or building alterations.

If, during INRMP activities on the Arsenal, Installation personnel and contractors observe items that might have historical or archaeological value, such observations will be reported immediately to the Army so that the Cultural Resource Manager may determine their significance and any special disposition of the finds. Activities in the area of the discovery that may result in the destruction of these resources would cease and personnel would be prevented from trespassing on, removing, or damaging such resources.

4.4 HAZARDOUS MATERIALS AND WASTE

The following sections describe the impacts to the environment from the Preferred Alternative and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to hazardous materials and waste.

4.4.1 Preferred Alternative

Hazardous materials (i.e., fertilizers and pesticides) would be used under the INRMP. The Proposed Action is to implement the INRMP in a timely and effective manner and ensure the wise protection, use, and management of resources within RSA. With a coherent management system, no significant impacts would result, since fertilizers and pesticides would be used and disposed of properly.

4.4.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented although basic ecosystem management would continue.

4.4.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact hazardous materials and waste in a cumulative manner; therefore, no cumulative impacts are expected.

4.5 HEALTH AND SAFETY

The following sections describe the impacts to the environment from the Proposed Action and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to health and safety.

4.5.1 Preferred Alternative

Beneficial impacts to health and safety are anticipated. The Preferred Alternative is to implement the INRMP in a timely, consistent, and effective manner and ensure the wise protection, use, and management of resources within the Arsenal. By establishing a coherent management system, existing health and safety conditions would be enhanced.

There would be positive impacts to fire safety on the Arsenal. Prescribed burning and maintenance of firebreaks and grazing lands, reduces fire danger. Firebreaks impede the progress of fires and are used as trails to transport fire fighting equipment to otherwise inaccessible areas. Using open lands for grazing also minimizes excess growth of grasslands and fire danger.

Prescribed burning on RSA will be conducted in accordance with AR 200-3, *Natural Resources Land, Forest, and Wildlife Management*; and TM 5-631, *Natural Resources Forestry Management* as identified in the INRMP Fire Protection Plan and Annual

Prescribed Burning Plan for FY 02-07. Operations are generally conducted during the winter months to reduce excessive, undesirable understory vegetation and encourage more acceptable habitat for wildlife species. An additional health and safety benefit derived from the burning program is the reduction of hazardous fuel accumulation. Approximately 1,300 acres of open range lands are burned annually, primarily to reduce the fire hazard on these ranges. Another 700 acres of forested areas are burned on a three-year rotational cycle to increase food supplies and maintain cover for wildlife.

4.5.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented. However, basic ecosystem management would continue. Prescribed burning would continue to reduce fire hazards as identified in RSA's Annual Prescribed Burning Plan. No significant impacts would be anticipated as a result of the implementation of the No Action Alternative.

4.5.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact health and safety in a cumulative manner; therefore, no cumulative impacts are expected.

4.5.4 Mitigation Measures

Under the INRMP, firebreaks and utility rights-of-way (which serve as firebreaks, in addition to their primary purpose) would be maintained to impede fire progress and serve as trails to transport fire-fighting equipment to otherwise inaccessible areas, should fires occur.

Prescribed burning on RSA will be conducted in accordance with AR 200-3, *Natural Resources Land, Forest, and Wildlife Management*; and TM 5-631, *Natural Resources Forestry Management* and as identified in the INRMP Annual Prescribed Burning Plan and the Fire Protection Plan as an additional health and safety benefit for the reduction of hazardous fuel accumulation.

4.6 INFRASTRUCTURE AND TRANSPORTATION

The following sections describe the impacts to the environment from the Proposed Action and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to infrastructure and transportation.

4.6.1 Preferred Alternative

There would be potentially beneficial impacts to infrastructure and transportation from implementing the INRMP. The Preferred Alternative is to implement the INRMP in a timely, consistent, and effective manner and ensure the wise protection, use, and management of RSA resources. By establishing a coherent management system to

prevent the overgrowth of vegetation along utility rights-of-way on the Arsenal, potential significant adverse impacts to infrastructure would be avoided. By controlling vegetation growth, utility access (e.g., power, natural gas, water and sewer lines) would be maintained. Utility outages from overgrown vegetation interfering with utility lines, utility substations, water treatment plants, wells, and wastewater pumping stations would be minimized. Proper maintenance of utility rights-of-way and firebreaks are mutually supportive, in that both protect infrastructure and minimize infrastructure loss and service disruptions whenever fire, natural disasters or other incidents occur.

4.6.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented. However, basic ecosystem management would continue. Grounds maintenance would continue to control utility rights-of-way and fire breaks. No significant impacts are anticipated from the implementation of this alternative.

4.6.3 Cumulative Impacts

Beneficial, cumulative impacts would be anticipated to infrastructure and transportation from implementing the INRMP. The overall time and cost to respond to fires and natural disasters, utility system disruptions and other incidents would be reduced and the associated mission disruptions and restoration costs minimized.

4.6.4 Mitigation Measures

Under the INRMP, the overgrowth of vegetation along utility rights-of-way, firebreaks and Installation roads would be managed to reduce potential significant adverse impacts from interruption and restricted access to utility systems and roadways. Firebreaks would be maintained for access by emergency vehicles.

4.7 LAND USE

The following sections describe the impacts to the environment from the Proposed Action and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to land use.

4.7.1 Preferred Alternative

There would be potential positive impacts to land use from implementing the INRMP. Currently, RSA lands are managed for multiple uses. The goal is to provide optimum wildlife habitat (for both game and non-game species) and quality timber production while supporting military mission requirements and consumptive as well as non-consumptive recreation.

Redstone Arsenal land areas are classified as improved grounds (3,605 acres), semi-improved grounds (8,953 acres), and unimproved grounds (25,915 acres). Table 4-2 quantifies current land use. The Proposed Action will implement the INRMP in a timely

and effective manner and ensure the wise protection, use, and management of RSA's resources. By establishing a coherent management plan on RSA, the land use areas (administration, airfield, community facilities, family housing, industrial, maintenance, medical, NASA, open space, outdoor recreation, range/test areas, supply/storage, training facilities, and unaccompanied personnel housing) would be programmatically maintained in concert with the Arsenal's natural resources.

Table 4-2. Current Redstone Arsenal Land Use

Land Use Category	Acres	Percent Distribution
Administration	2,112	5.6
Airfield	440	1.2
Community Facilities	267	0.7
Family Housing	524	1.4
Industrial	1,065	2.8
Maintenance	217	0.6
Medical	38	0.1
NASA	1,826	4.8
Open Space	5,645	14.9
Outdoor Recreation	1,302	3.4
Range/Test Areas	15,818	41.7
Supply/Storage	2,080	5.5
Training Facilities	6,384	16.8
Unaccompanied Personnel Housing	250	0.7
TOTAL:	37,968	100.0

Source: Real Property Master Plan Land Use Analysis, Redstone Arsenal, Alabama, April 1999

Under this alternative, the Installation size could change if the refuge boundaries are expanded, if additional buffers are established to protect ecologically significant resources or water resources, or if new special natural habitat areas are established. These land-use changes would result in benefits to biological resources. In addition, slight land use changes or disturbances may occur because of environmental education projects (e.g., environmental education centers or trails). These changes or disturbances are considered minor, and would be offset by positive impacts associated with a more informed public. Any changes in recreation areas could also affect land use.

The current use of available hay production and grazing lands would continue. This would result in proper use of the land and a continued source of revenue for the Arsenal

(revenue is discussed in the Socioeconomics section of this EA). Currently, there are 3,769 acres of available agricultural land leased to private individuals under five year contracts for production of hay crops and pasture (cattle grazing). Grazing activities from 2002 through 2007 would support approximately 1,885 head of cattle per year.

Implementing the INRMP's Forest Management Plan would improve sustainability of healthy, diverse, and productive forest resources on the Installation. Additionally, visual enhancements would result from the structured replanting of harvested areas and the continued improvement of timber stands. Commercial forestlands would continue to be properly maintained and logging operations would continue as well. Varied forest compartments are planned for timber harvesting each year from 2002 through 2007. The schedule is based on inventory findings and serves as a guide for the next five year harvest. Harvests are aimed toward reducing many of the overstocked timber stands in order to increase the rate of growth and simultaneously decrease the rate of mortality. (U.S. Army Missile Command, 1994)

The prescribed burning program on the Arsenal would continue and this would result in an additional decrease in wildfire danger. The cemeteries on the Arsenal would be maintained (and remain clean and undisturbed). Off-road vehicle use on the Installation would continue to be banned.

4.7.2 No Action Alternative

If the No Action Alternative is chosen, the INRMP would not be implemented and basic ecosystem management would continue. No significant impacts are anticipated, and beneficial impacts would be expected for land use.

4.7.3 Cumulative Impacts

There would be positive, cumulative impacts expected to land use from implementing the INRMP, as a result of multiple use of Arsenal lands and the associated long-term improvements to forests and fish and wildlife habitat quality and biodiversity.

4.8 NOISE

The following sections describe the impacts to the environment from the Proposed Action and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to noise.

4.8.1 Preferred Alternative

There would be no significant impacts from noise from implementing the INRMP. Normal noise producing activities on the Arsenal would continue but would not be affected by the INRMP nor would the INRMP cause any excessive noise during its implementation.

The primary sources of noise associated with implementing the INRMP would be from timber harvesting activities or equipment used in preparing food plots, hay crop production, or normal agriculture leased land maintenance activities. While wildlife may temporarily move away from these noise-producing activities, they will not be significantly impacted and would be expected to return to the area when the noise producing activity ceases.

4.8.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented. However, basic ecosystem management would continue. There would be no impacts from noise because there would be no change to the general types of activities in the area.

4.8.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact noise in a cumulative manner; therefore, no cumulative impacts are expected.

4.9 GEOLOGY AND SOILS

The following sections describe the impacts to the environment from the Preferred Alternative and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to geology and soils.

4.9.1 Preferred Alternative

There would be potentially positive impacts to geology and soils from implementing the INRMP. The Preferred Alternative is to implement the INRMP in a timely and effective manner and ensure the wise protection, use, and management of resources within the Arsenal. The establishment a coherent management system to minimize soil erosion through the INRMP avoids potential significant impacts to geology and soils (e.g., sheet flow and gully erosion). By controlling these erosion factors, siltation and turbidity of water bodies would also be minimized.

The INRMP outlines a management system for natural resources. By having procedures in place prior to any land disturbances such as new construction, new recreational areas, and additional logging, the INRMP would provide a positive impact to RSA soils. Adverse impacts (e.g., soil erosion and siltation of waterways) would be minimized by following the lands maintenance and soil erosion control measures and guidelines found in the INRMP, including the AMCOM Erosion Control Plan. Having approved procedures in place prior to awarding contracts that involve land disturbances, would allow the contractor to include erosion control costs in the project budget.

4.9.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented although basic ecosystem management would continue. No significant impacts would be anticipated to the soils or geologic features. Soil erosion would continue to be managed by the AMCOM Erosion Control Plan. Any adverse impacts to geology would not be anticipated under this alternative.

4.9.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact geology and soils in a cumulative manner; therefore, no cumulative impacts are expected.

4.10 SOCIOECONOMICS

The following sections describe the impacts to the environment from the Preferred Alternative and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to socioeconomics.

4.10.1 Preferred Alternative

There would be no significant impacts to socioeconomics from the implementation of the INRMP. There would be no impacts to population or employment in the region. There would be beneficial impacts to on-base recreation facilities and to the economics on RSA from grazing, timber cutting, and associated agricultural lease activities.

Impacts to outdoor recreation facilities on the Arsenal would be positive. The golf course, playing fields, picnic areas, campgrounds, boat ramps, fishing piers, and swimming facilities would be maintained and facilities kept in good repair. Opportunities for non-consumptive recreational activities would also be enhanced (*e.g.* bird and wildlife watching).

The Preferred Alternative is to implement the INRMP in a timely, consistent, and effective manner and ensure the wise protection, use, and management of RSA resources. With a coherent management plan, grazing activities, logging operations, and agricultural lease arrangements would provide a source of revenue. These activities provide revenue from direct cash leases as well as indirect value to the government (*e.g.*, mowing, seeding, fertilization, and fence construction by the lessee). The total value received by the government is estimated at \$244,985 per annum on 3,769 acres of agricultural lease land. The services received from leasing the land include mowing, seeding eroded areas, clearing, seeding pastures, maintenance of drainage ways, fertilization, and weed control. The total estimated annual income for timber harvesting over the next five years is \$388,000 while operating costs for the forestry program have been budgeted at \$260,300 per year. Money derived from the sale of hunting and fishing permits would continue to be used exclusively for the management of fish and wildlife resources at the Arsenal. (U.S. Army Missile Command, 1994)

The most apparent beneficial impact associated with the Preferred Alternative results from the coordinated nature of implementation of an INRMP. The INRMP would be integrated with other Installation plans. As a result of this coordination, resource management activities would result from one plan and would be carried out more efficiently and effectively resulting in cost savings and beneficial impacts to all resource types.

4.10.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented. However, basic ecosystem management would continue and no significant impacts are anticipated. There would be no impacts to population or employment in the region. Without master planning guidance, changes in grazing activities, logging operations, and agricultural lease arrangements might occur. These changes could result in a decrease in lease revenue to the Arsenal as well as a decrease in the services that provide indirect value to the government (e.g., mowing, seeding, fertilization, fence construction by the lessee). Timber sales could be reduced along with the associated revenues. Without the coordination of resource management activities, all plans would be carried out independently thereby reducing the efficiency and effectiveness of natural resource management.

4.10.3 Cumulative Impacts

There are no additional past, present, or reasonably foreseeable actions that would be expected to impact socioeconomics in a cumulative manner; therefore, no cumulative impacts are expected.

4.11 WATER RESOURCES

The following sections describe the impacts to the environment from the Preferred Alternative and the No Action Alternative, cumulative impacts, and potential mitigation measures pertaining to water resources.

4.11.1 Preferred Alternative

Beneficial impacts to water resources are anticipated. The Preferred Alternative is to implement the INRMP in a timely and effective manner and ensure the wise protection, use, and management of RSA resources. By establishing a coherent management system to prevent the siltation and erosion of stream banks, negative impacts to water resources would be avoided.

The INRMP outlines management details for water resources. Practices to control erosion to prevent impacts to streams (primarily siltation) are specified, along with methods to minimize negative impacts to streams from forestry harvests (uneven-age system of harvest) and devegetation (distance restrictions from cuts to waters edge). By coordinating RSA activities under the INRMP, potential significant adverse impacts to water resources would be minimized. Providing guidelines to RSA personnel and

contractors prior to the commencement of activities that could potentially impact water resources, and ensuring that they follow good management practices for construction activities, would avoid unnecessary costs to correct contamination problems and protect valuable natural resources. Prior planning would also allow contractual agreements to include measures to avoid impacting water resources.

Providing alternate water supplies for cattle and using fencing to exclude cattle from stream banks and wetlands would keep cattle from eroding stream banks and polluting streams and wetlands with excretions. This practice would protect surface water and groundwater resources on the Arsenal. Ensuring that logging activities follow good forestry management practices regarding buffer zone distances from streams would reduce soil erosion and streams siltation.

4.11.2 No Action Alternative

If the No Action Alternative were chosen, the INRMP would not be implemented although basic ecosystem management would continue. No significant impacts are anticipated from this alternative.

4.11.3 Cumulative Impacts

Implementing the INRMP should result in long-term, positive cumulative impacts to water quality. These positive cumulative impacts would result from good erosion control measures and subsequent decreases in stream siltation and minimal stream bank erosion and stream and wetland pollution by supplying alternate water supplies and cattle fencing.

4.12 CUMULATIVE IMPACTS

Cumulative effects can become potentially critical when the chosen action (for example, developing an INRMP with specific, targeted management initiatives) interacts, either directly or indirectly, with other unrelated actions (past, present, or in the foreseeable future). This type of interaction should be rare because an INRMP by design incorporates existing Installation planning documents and management plans, and is to be reviewed and updated routinely (every 5 years at a minimum). INRMPs are designed to follow an ecosystem approach. They also involve establishing partnerships with federal, state, and local groups. These INRMP characteristics further reduce the possibility for cumulative effects arising that have not already been considered within the INRMP. By their nature, integrated planning, ecosystem management, and partnering are techniques that reduce cumulative effects. As new, relevant issues or initiatives arise, they would be considered in the INRMP at either the annual review or 5-year review periods. In this way, the INRMP is maintained as an active reference document that describes Redstone Arsenal's planned natural resources management for the current 5-year period.

Outside the actions included in the INRMP, several general actions may result in cumulative effects. For example, major changes in the AMCOM military mission; major funding or personnel reductions; and significant changes in local, county, or state

planning and development (for example, changes in land use of the surrounding area, major highway construction) could interact with natural resources management initiatives at RSA and result in cumulative effects. Both the Basic Ecosystem Management Alternative (No Action Alternative) and Integrated Ecosystem Management under and INRMP (Preferred Alternative) were examined to determine the potential cumulative effects that may arise under each of these potential future conditions.

Both of these alternatives have a significant potential for identifying potential conflicts or cumulative impacts early. In addition, the Preferred Alternative provides RSA's natural resource managers with a reasonable ability to respond to issues that could potentially result in negative cumulative effects. The Preferred Alternative contains sufficient flexibility in its initiatives to allow adaptive management. The increased management efforts for water, soils, and wildlife and habitat resources under the Preferred Alternative, as well as the integration of the management activities would place RSA in a favorable position to respond to and limit negative cumulative effects. Changes in mission, funding, or personnel reductions or changes in off-post land-use planning and development would be responded to through adaptive management and would be incorporated into the subsequent update of the INRMP. Updating the INRMP could realign the management intensities to support mission or other changes and so avoid cumulative effects.

Specific positive cumulative impacts to biological resources (and biodiversity), infrastructure and transportation, land use, and water resources would be expected from implementing the INRMP.

Forested areas would be managed for multiple use. Prescribed burning and selective tree cutting would improve wildlife and bird nesting cover and provide legume seed supplies. Wildlife food plots would increase the populations of game and nongame species. Threatened and endangered species and their habitat would also be enhanced.

The overall time and cost to respond to fires and natural disasters, utility system disruptions and other incidents would be reduced and the associated mission disruptions and restoration costs minimized for infrastructure.

There would be positive, cumulative impacts expected to land use from implementing the INRMP, as a result of multiple use of Arsenal lands and the associated long-term improvements to forests and fish and wildlife habitat quality and biodiversity.

Positive cumulative impacts to water quality would result from good erosion control measures and subsequent decreases in stream siltation, and minimal stream bank erosion and stream and wetland pollution by supplying alternate water supplies and cattle fencing.

4.13 INDIVIDUALS/AGENCIES RESPONSIBLE FOR OBTAINING REQUIRED PERMITS/LICENSES/ENTITLEMENTS

Redstone Arsenal would coordinate with the Alabama State Forestry Commission and the City of Huntsville Air Quality Control Coordinator to acquire permits to initiate prescribed burning activities and determine smoke management conditions. The Arsenal would also comply with Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbor Act of 1899, the ESA, and additional rules and regulations specified by the federal government and State of Alabama, by coordinating with the proper resource agencies and obtaining all required permits prior to work.

4.14 CONFLICTS WITH FEDERAL, STATE, OR LOCAL LAND USE PLANS, POLICIES, AND CONTROLS

The INRMP for Redstone Arsenal would have no significant impacts on the existing land use itself and presents no conflicts with federal, regional, state, or local land use plans, policies, or controls.

4.15 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Anticipated energy requirements of INRMP activities can be accommodated within the energy supply of the region. Energy requirements would be subject to any established energy conservation practices.

4.16 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL

Other than the use of vehicle fuels to oversee the plan, no significant use of natural or depletable resources is required by the action.

4.17 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

Although the Proposed Action would result in some irreversible and irretrievable commitment of resources such as fuel and labor, this commitment of resources is not significantly different from that necessary for everyday activities taking place on the Arsenal during normal operations.

4.18 BIOLOGICAL DIVERSITY

Biological diversity (biodiversity), or the variety of life and its processes, is a basic property of nature that provides enormous ecological, economic, and aesthetic benefits. The loss of biodiversity is recognized as a major national as well as global concern with potentially profound ecological and economic consequences.

Conservation of biodiversity is a national goal provided for in the framework of NEPA. This goal is to anticipate and evaluate the effects of federal actions on biodiversity and

actively manage for the reduction of the impact of these effects as well as the promotion of restoration to previously impacted areas.

The basic goal of biodiversity conservation is to maintain naturally occurring ecosystems, communities, and native species. For the Proposed Action evaluated in this EA, there would be beneficial impacts to the biodiversity of the region of influence. Proper and timely implementation of prescribed burns, selected timber harvest, and placement of food plots can enhance biodiversity and improve forestry and fish and wildlife resources.

Prescribed burning would reduce fire hazards and enhance the burned areas for a variety of wildlife and associated plant species that thrive under controlled burn situations. Under the INRMP, management of forestry and fish and wildlife resources on RSA would be expected to increase the biodiversity of these resources. Existing hardwood stands would remain and be increased annually. Pines harvested under the INRMP guidelines would establish openings to provide valuable “edge effect” and an increase in biodiversity. Food plots would be established and maintained to enhance consumptive and non-consumptive recreational activities, as these areas attract a variety of wildlife (game and non-game species) and neotropical birds.

Suggestions to minimize any anticipated impacts for planned or previous construction in the region of influence, and subsequently increase biodiversity in this area, include:

- Incorporate measures to minimize landscape fragmentation;
- Link blocks of originally connected habitat through landscape corridors;
- Utilize native species in landscape plantings and food forage plots; and
- Monitor for biodiversity impacts and for changes in biodiversity.

4.19 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

There are no adverse environmental effects from the Proposed Action that cannot be avoided or minimized. There will be some short-term impacts to the environment from activities associated with implementing the INRMP. Forestry and maintenance activities are often noisy and disruptive. Birds and other wildlife would relocate from the impacted areas while disruptive activities are on-going and move back into the area when the activities have ended. It is the intent of the INRMP to leave impacted areas in better condition as suitable and more diverse wildlife habitat than they were initially. While habitat improvements and increased biodiversity may not be immediately evident, positive effects to the bird and wildlife habitat and diversity should be evident in a relatively short time. It is important that disruptive activities be avoided, when possible, in sensitive areas during peak breeding and nesting seasons. This determination would be made in consultation with the Arsenal’s Natural Resources Manager. Overall impacts from implementing the INRMP are considered positive.

4.20 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The Proposed Action to implement the INRMP would insure sustainable yields of timber, habitat quality, important resource protection, and long-term sustainable recreation.

4.21 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS

The Proposed Action would be undertaken in a manner that would not substantially affect human health or the environment. The INRMP is intended to benefit natural resources and the overall ecosystem, and harmful effects on either the natural or human environment are not anticipated. The Proposed Action would also be conducted in a manner that would not exclude persons from participation in, deny persons the benefits of, or subject persons to discrimination under, the program actions because of their race, color, or national origin.

4.22 CONDITIONS NORMALLY REQUIRING AN ENVIRONMENTAL IMPACT STATEMENT

The potential impacts arising from the INRMP for RSA were evaluated specifically in the context of the criteria for actions requiring an Environmental Impact Statement described in DoD Directive 6050.1, Environmental Effects in the United States of Department of Defense Actions (U.S. Department of Defense 1979), and 32 CFR Part 651, Environmental Analysis of Army Actions (U.S. Department of the Army, 2002).

Specifically, the proposed project activities were evaluated for their potential to:

- significantly affect environmental quality or public health and safety;
 - significantly affect historic or archaeological resources, public parks and recreation areas, wildlife refuge or wilderness areas, wild and scenic rivers, or aquifers;
 - adversely affect properties listed or meeting the criteria for listing on the National Register or the National Registry of Natural Landmarks;
 - significantly affect prime and unique farmlands, wetlands, ecologically or culturally important areas, or other areas of unique or critical environmental concern;
 - result in significant and uncertain environmental effects or unique or unknown environmental risks;
 - significantly affect a species (or its habitat) that is listed or proposed for listing under the endangered species act;
 - establish a precedent for future actions;
 - adversely interact with other actions resulting in cumulative environmental effects;
- and

- involve the use, transportation, storage, and disposal of hazardous or toxic materials that may have significant environmental impact.

The evaluation indicated that the Integrated Natural Resources Management Plan for Redstone Arsenal, as described in this EA, did not meet any of these criteria.

CHAPTER 5.0 CONCLUSION

This environmental assessment reviewed the proposed management of Redstone Arsenal's natural resources. Two management options were examined. The Preferred Alternative would most effectively manage and preserve RSA's natural resources as required by federal regulations and DoD and Army policies. If the Preferred Alternative to the Proposed Action were selected, Redstone Arsenal would implement the INRMP in a timely and effective manner. The INRMP would outline procedures for managing soil, timber, grassland, and water resources, for the benefit of resident fish and wildlife resources. The plan would serve as a guide for developing and maintaining Arsenal lands consistent with the military mission and national policies on conservation of resources.

Under the Preferred Alternative, compliance with applicable state and federal laws as well as pertinent DoD and Army regulations and guidance documents would continue. Emphasis would be placed on objectives that stress the importance of ecosystem integrity and biodiversity. Under this alternative, there would be no significant impacts to air quality, hazardous materials and waste, or noise. Beneficial impacts would be anticipated to biological resources, cultural resources, health and safety, infrastructure and transportation, land use, geology and soils, socioeconomics, and water resources. In addition, there are no cumulative impacts expected under this alternative. Mitigation measures in addition to those specified in Chapter 4 are not necessary to reduce impacts to a less than significant level.

The most apparent beneficial impact associated with the Proposed Action results from the coordinated nature of implementation of an INRMP. The INRMP would be integrated with other Installation plans (*i.e.*, the Cultural Resources Management Plan, the Forestry Management Plan, the Endangered Species Management Plan, etc.). As a result of improved coordination, there would likely be beneficial impacts to all resource categories. All resource management activities would result from one plan and would be carried out more efficiently and effectively, resulting in cost savings and beneficial impacts to all resource types.

If the No Action Alternative were selected, RSA would continue to implement the overall program philosophy and practices under the existing natural resources program. Under this alternative, various management plans would continue to be used, in whole or in part, to support the Installation's natural resources program. However, these plans would not be integrated with each other, nor would they be integrated with other relevant Installation plans.

The No Action Alternative does not comply with DoD and Army regulations that mandate the preparation and implementation of INRMPs. Regulations that mandate the preparation and implementation of INRMPs for all DoD installations include the SAIA; DoD Instruction 4715.3, *Environmental Conservation Program*, and AR 200-3, *Natural Resources—Land, Forest, and Wildlife Management*. Under this alternative, there are no significant impacts to air quality, hazardous materials and waste, or noise. Beneficial

impacts would be anticipated for biological, and cultural resources, health and safety, infrastructure and transportation, land use, geology and soils, socioeconomics, and water resources.

The potential impacts for both of the alternatives are presented in Table 5-1.

Table 5-1. Comparison of Impacts for the Alternatives Based on Significance Criteria and Thresholds

RESOURCE	PREFERRED ALTERNATIVE	NO-ACTION ALTERNATIVE
Air Quality	X	X
Biological Resources	+	+
Cultural Resources	+	+
Hazardous Materials and Waste	X	X
Health and Safety	+	+
Infrastructure and Transportation	+	+
Land Use	+	+
Noise	X	X
Geology and Soils	+	+
Socioeconomics	+	+
Water Resources	X	X

-- No Impact

X No Significant Impact

+ Positive Impact

CHAPTER 6.0 LIST OF PREPARERS

Larry W. Blackwell
Director, Environmental Programs
M.A., Human Relations, Louisiana Technical University, 1988
B.F.A, Advertising, Louisiana Technical University, 1971

Danny Brandon
Environmental Specialist
B.S., Business Administration, Columbia College, 2002
A.S., Bioenvironmental Engineering, Community College of the Air Force, 1997

Michael J. Landers
Senior Environmental Scientist
B.S., Environmental Science, Washington State University, 1995

Susan Pearsall
Senior Environmental Scientist
M.S., Environmental Biology, University of Alabama in Huntsville, 1999
B.S., Zoology, Auburn University, 1993.

Jeffery H. Scott, Ph.D.
Senior Fish and Wildlife Biologist
Ph.D., Aquatic Ecology/Limnology, Auburn University, 1990
M.S., Biology, Auburn University, 1982
B.S., Biology, Auburn University, 1977

CHAPTER 7.0 INDIVIDUALS/AGENCIES CONSULTED

7.1 Agencies/Organizations/Individuals Sent Copies of the Assessment

As part of the CEQ Regulations on the National Environmental Policy Act, AMCOM is circulating the Final Environmental Assessment of the Integrated Natural Resources Management Plan for Redstone Arsenal to the following agencies, organizations, and individuals.

Alabama State Historic Preservation Office, Montgomery, Alabama

U.S. Army Aviation and Missile Command, Directorate of Environment and Safety, Natural Resources Division, Redstone Arsenal, Alabama

U.S. Environmental Protection Agency, Region IV, Office of Environmental Assessment, Atlanta, Georgia

U.S. Fish and Wildlife Service, Ecological Services Division, Daphne, Alabama

7.2 Individuals and Agencies Contributing to the Project

Daniel J. Dunn, Environmental Protection Specialist, U.S. Army Aviation and Missile Command, Directorate of Environment and Safety, Redstone Arsenal, Alabama

Jesse Horton, Installation Forester, U.S. Army Aviation and Missile Command, Directorate of Environment and Safety, Redstone Arsenal, Alabama

David Nixon, Wildlife Biologist, U.S. Army Aviation and Missile Command, Directorate of Environment and Safety, Redstone Arsenal, Alabama

Susan Weber, Environmental Protection Specialist, U.S. Army Aviation and Missile Command, Directorate of Environment and Safety, Redstone Arsenal, Alabama

CHAPTER 8.0 REFERENCES

Alabama Cooperative Extension Service Circular ANR-65, no date. *Kudzu in Alabama, History, Uses, & Control*, Auburn University.

Alabama Natural Heritage Program, 1995. *Draft Natural Heritage Inventory of Redstone Arsenal: Federally Listed Endangered, Threatened, Candidate, and State - Listed Species, October*.

Horton, J., 2002. Personal communication with Horton, Installation Forester, U.S. Army Aviation and Missile Command, Directorate of Environmental Management, Natural Resources Branch, and SpecPro, Inc., regarding forestry program, September 5.

Nixon, D. 2002. Personal communication between Nixon, Wildlife Biologist, U.S. Army Aviation and Missile Command, Directorate of Environmental Management, Natural Resources Branch, and SpecPro, Inc., regarding biological resources on Redstone Arsenal, September.

Soil Conservation Service, 1980. Huntsville Field Office Technical Guide, Section II-A, May.

U.S. Army Aviation and Missile Command, 1999. *Final Real Property Master Plan Land Use Analysis for Redstone Arsenal*, April.

U.S. Army Aviation and Missile Command, 2002a. *ACTS Report*, February 5.

U.S. Army Aviation and Missile Command, 2002b. *Integrated Natural Resources Management Plan for Redstone Arsenal, Parts I, II, III, IV*, May.

U.S. Army Corps of Engineers, 1987. *Wetlands Research Program Technical Report Y-87-1, Corps of Engineers Wetlands Delineation Manual*, January.

U.S. Army Missile Command, 1994. *Final Environmental Assessment for Redstone Arsenal Master Plan Implementation, Redstone Arsenal, Alabama*, December.

U.S. Department of the Army, 1985. *Army Material Command Safety Manual, Regulation 385-100*, August 1.

U.S. Department of the Army, 2002. *Environmental Analysis of Army Actions*, 32 CFR Part 651, March 29.

U.S. Department of Defense, 1979. *Environmental Effects in the United States of Department of Defense Actions*.

U.S. Environmental Protection Agency, 2002. "Alabama NPL/NPL Caliber Cleanup Site Summaries," www.epa.gov/region4/waste/npl/nplal/redstnal.htm, September 3.

Weber, S. 1996. Personal communication between Weber, Environmental Protection Specialist, U.S. Army Missile Command Environmental Office, and Vista Technologies, regarding vegetative communities on Redstone Arsenal, Spring.

Weber, S. 2002. Personal communication between Weber, Environmental Protection Specialist, U.S. Army Aviation and Missile Command, Directorate of Environmental Management, and SpecPro, Inc., regarding vegetative communities on Redstone Arsenal, Summer 2002.

APPENDIX A

Correspondence From Coordinating Agencies



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

APR 29 2003

**Dr. Jeffery H. Scott
Senior Fish and Wildlife Biologist
Vista Technologies
5001 Technology Dr.
Huntsville, AL 33805**

**Subject: Environmental Assessment (EA) for Implementation of A Natural
Resources Management Plan for Redstone Arsenal (RA), Madison
County, AL (dtd. October, 2002)**

Dear Dr. Scott:

Pursuant to Section 309 of the Clean Air Act, EPA, Region 4 has reviewed the subject document focusing on its overall effectiveness/completeness. In this regard the five-year Plan is well-written and appears to be based on sound biological science coupled with practical suggestions for implementing resource protection. The proposed program elements are a reasonable vehicle for inventorying resources, making financial commitments, and appropriately will integrate natural resources management into the other installation plans.

On the basis of our review we have no significant objections to the anticipated "Finding of No Significant Impact" for this action and by extension the use of an EA as the evaluation model rather than the more comprehensive environmental impact statement format.

Thank you for the opportunity to comment. If you wish to discuss this matter in further detail, Dr. Gerald Miller(404-562-9626) will serve as initial point of contact.

Sincerely,

A handwritten signature in black ink, appearing to read "Mueller", is positioned above the typed name.

**Heinz J. Mueller, Chief
Office of Environmental Assessment**

JUN-12-2003 15:26

DIR ENVIRONMENTAL MGMT

2568760887

P.03/04



STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
468 SOUTH PERRY STREET
MONTGOMERY, ALABAMA 36130-0900

LEE M. WARNER
EXECUTIVE DIRECTOR

TEL: 334-242-3184
FAX: 334-240-3477

May 30, 2003

Terry Hazle, Director
Directorate of Environment and Safety
Department of the Army
United States Army Garrison - Redstone
4488 Martin Road
Redstone Arsenal, Alabama 35898-5000

Re: AHC 2003-0754
Draft EA, Implementation of Natural Resources Management Plan,
Redstone Arsenal
Madison County

Dear Mr. Hazle:

Upon review of the above referenced Environment al Assessment, the Alabama Historical Commission has determined the following. We agree provided that the plan is consistent with the plan is consistent with the Cultural Resources Management Plan and that Section 106 coordination is implemented for each individual project as stated in the Environment al Assessment.

We appreciate your efforts to help us in preserving Alabama's non-renewable cultural resources. If you have questions or comments or if we may be of additional service, please contact Amanda McBride or Stacye Hathorn of our office and include the AHC project number referenced above.

Very truly yours,

Elizabeth Ann Brown
Deputy State Historic Preservation Officer

EAB/ALM/sgh



IN REPLY REFER TO:
03-1483

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P. O. Drawer 1190
Daphne, Alabama 36526

September 26, 2003

Dr. Jeffrey H. Scott
SpecPro
215 Wynn Drive, Suite 321
Huntsville, AL 35805

Dear Dr. Scott:

We are responding to your email, dated September 25, 2003, requesting review of the Draft Environmental Assessment (EA) for the Integrated Natural Resources Management Plan (INRMP) for U.S. Army Garrison-Redstone, Redstone Arsenal, Madison County, Alabama. We have reviewed the information and are providing the following comments in accordance with the Sikes Act (74 Stat. 1052, as amended; 16 U.S.C. 670a-670o), the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.) and the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

The Service concurs with your assessment that the preferred alternative to implement the INRMP would be the most effective way to manage and preserve the natural resources found on Redstone Arsenal. Under the integrated ecosystem management approach, ecosystem integrity and biodiversity are emphasized. We also agree that consolidating all resource management under one plan would be more efficient and effective, resulting in beneficial impacts to all resource areas.

If you have any questions or need additional information, please contact Mr. Bruce Porter at (251)441-5864.

Sincerely,

Larry E. Goldman
Field Supervisor

PHONE: 334-441-5181

www.fws.gov

FAX: 334-441-6222

SHIPPING ADDRESS: 1208-B Main Street, Daphne, AL 36526